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ABSTRACT

This report presents a summary of programs in junior colleges, vocational/technical training institutes, community colleges, four-year colleges, and universities as well as other training institutions. It represents a sample, only, of the various programs available nationwide. The programs presented here have a focus or emphasis on two or more environmental areas or are environmentally-related but are not specific to any one area. The report is divided into engineering/health programs and education/ecology programs; 93 of the first group programs were surveyed in 32 states, and 37 of the second group programs were surveyed in 17 states. Statistics are given on states, institutions, programs, and degrees; enrollment, graduates, and faculty; curricula; research funding and sources of financial support; and employment. (BB)

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Post Secondary Education Profile

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COMPOSITE II

(Education/Ecology)

Phase II
Of A National Environmental/Energy Workforce Assessment

Conducted by:

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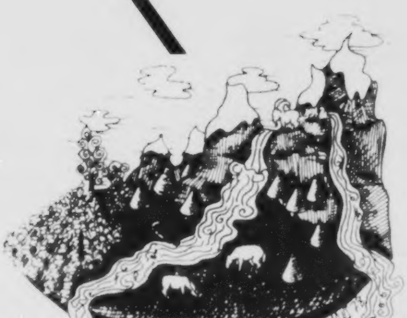

SE 025 200

NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT

PHASE II

POST-SECONDARY EDUCATION PROFILE

COMPOSITE II
EDUCATION/ECOLOGY

Conducted by:

NATIONAL FIELD RESEARCH CENTER, INC.

Under Grant from:

UNITED STATES

ENVIRONMENTAL PROTECTION AGENCY

Grant #T900591

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INTRODUCTORY NOTE

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Appreciation is extended to the many individuals, institutions, and organizations who generously contributed to the success of this national project. Of particular import are those contact persons listed in the program summaries. Their time and assistance in preparation, input and review represents the foundation upon which the National Environmental/ Energy Workforce Assessment - Phase II rests.

Sincere appreciation is expressed to those persons within the United States Environmental Protection Agency, Office of Federal Activities, who provided guidance and direction throughout the term of the project: Mr. J. Donald Cook, Project officer; Mr. Joseph McCabe, and Mr. Michael Moore. Special thanks are also extended to Mr. Tahlman Krumm, Ohio State University.

Gratitude must be expressed to the many individuals and organizations from the private sector who were most generous in their contribution to this project. Their openness and responsiveness reflect their concern regarding the training of our environmental workforce and their critical role in that effort.

REVIEW COMMITTEE

A special word of acknowledgement is extended to the following people who graciously gave of their time, knowledge and experience in order to review and comment on the information included in this volume. The efforts of this national committee were particularly insightful, and in general have been incorporated into the final report.

It must be pointed out that in all cases the individuals acknowledged below were asked only to review and comment on the material contained in the volume and to express their views regarding the representativeness of the material presented. They were not asked to endorse either the volume or the study in general, and the inclusion of their name on this list should not be considered an endorsement since such was not the intent.

In light of numerous responsibilities, it is especially important to note that these persons responded within very strict time constraints. Such a pattern reflects positively on both the individuals and the institutions and organizations which they represent.

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FOREWORD

Information for this report was largely compiled from on-site interviews with professionals in post-secondary institutions throughout the United States. On-site interviews were supplemented by telephone and/or mail contact to clarify and revalidate the data. This report presents a summary of programs in junior colleges, vocational/technical training institutes, community colleges, four-year colleges, and universities as well as other training institutions. Programs are representative of all levels from academic certification through doctoral degrees. The environmental pollution control areas of air, noise, pesticides, potable water, radiation, solid waste, wastewater and energy were surveyed.

This study was conducted for the United States Environmental Protection Agency by the National Field Research Center, Inc. of Iowa City, Iowa, with field offices located in Atlanta, Georgia; Denver, Colorado; and Washington, D.C.

NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT

PHASE II

POST-SECONDARY EDUCATION PROFILE

COMPOSITE SUMMARY

THE FOLLOWING PAGES PRESENT AN OVERVIEW, IN SUMMARY FORM, OF BOTH VOLUMES OF THE COMPOSITE REPORT. WHILE THE SUMMARY SYNOPSIZES ENGINEERING/HEALTH AND EDUCATION/ECOLOGY PROGRAM AREAS, INTERESTED READERS ARE ENCOURAGED TO REFER TO BOTH COMPOSITE VOLUME I (ENGINEERING/HEALTH) AND COMPOSITE VOLUME II (EDUCATION/ECOLOGY) FOR A MORE IN-DEPTH PRESENTATION OF PROGRAMS.

COMPOSITE

The Composite category accomodates those programs whose focus, structure, curriculum content, and specialized options indicate an overlapping emphasis in two or more environmental areas surveyed in Phase II or whose emphasis is environmentally related but not specific to any one area. This category is further divided into Engineering/Health and Education/Ecology sections; the former reflects a more technological emphasis while the latter integrates coursework in the natural, physical, and social sciences. This conceptual split in the composite category was intended to generate a more interpretable data base; however, the differences between the two sections are not substantial.

A. STATES, INSTITUTIONS, PROGRAMS, AND DEGREES

The Post-Secondary Education Profile (Phase II) surveyed 93 Engineering/Health programs in 32 states and 37 Education/Ecology programs in 17 states. In total, these programs represent a wide spectrum of degree offerings--from the diploma to the doctorate--and curriculum options. Given that 49 of the 93 institutions included in the composite sections offer more than one degree and 16 offer more than one environmental program, any list of schools surveyed in the Post-Secondary Inventory quantitatively represents many more curriculum opportunities than it suggests. The following table lists the number of programs surveyed by degree in the Composite category. For purposes of this summary, the Engineering/Health and Ecology/Education programs are combined.

COMPOSITE DEGREES, PROGRAMS, AND STATES

Degree	Number of Programs	States
Certificate (graduate level)	1	Alabama Alaska Arkansas California Connecticut Delaware District of Columbia Florida Georgia Indiana Iowa Kansas Kentucky Louisiana Maine Maryland Massachusetts Michigan Minnesota New Jersey New York North Carolina Ohio Oklahoma Pennsylvania South Carolina Tennessee Texas Utah Virginia Washington West Virginia Wisconsin
Diploma	1	
Associate	12	
Bachelors	38	
Masters	18	
Environmental Engineering	1	
Multiple Degree		
Cert/Asso/Bach/Mast/Doct	1	
Associate/Bachelors	2	
Bachelors/Masters	11	
Bachelors/Masters/Doctoral	15	
Masters/Doctoral	29	
Masters/Doctoral/Engineer	1	
TOTAL	130	33

B. ENROLLMENT STATISTICS AND GRADUATES

National summaries of enrollment and graduates per annum for the Composite programs surveys are reported in the following table. These data indicate that approximately three-fifths (58%) of the graduates in the Composite programs are awarded degrees at the bachelors level. The relative scarcity of sub-baccalaureate programs may in part be due to the four-year program requirements normally mandated in engineering and teacher training programs. Enrollment statistics indicate that 54%

NATIONAL COMPOSITE PROGRAMS

ENROLLMENT PROFILE SUMMARY

Degree	Enrollment		Graduates Average # Per Year	Enrollment Change by Program		
	Full-time	Part-time		Up	Down	Stable
Diploma	14	0	8	0	1	0
Associate	329	70	138	3	4	6
Bachelors	6,206	376	1,586	32	3	24
Masters	1,567	660	905	21	8	42
E.E.	4	12	9	0	1	1
Doctoral	279	76	104	10	5	31
TOTAL	8,399	1,194	2,750	66	22	104

of the Composite programs are experiencing stable enrollment and 34% are sustaining growth.

Percentages of in-state/out-of-state/foreign students show a fairly linear increase by degree level. That is to say, graduate programs have higher numbers of out-of-state and foreign students than undergraduate programs. This result is not surprising if one considers the capacity of the graduate programs--with their research facilities and tuition remission and assistantship plans--to attract students from a wider geographical radius.

Recruitment techniques are relatively standard across these composite programs and include posters, brochures, visits to local high schools, and campus career days. Those programs with extensive facilities, traineeships, or other curricular or financial attractions find such inducements facilitate recruitment. The effectiveness of any one method is difficult to assess across programs and is undoubtedly the function of many intervening variables.

C. FACULTY

A total of 992 (62%) full and 610 (38%) part-time members serve the 130 composite training programs surveyed. Of these, 832 (68%) full and 383 (32%) part-time faculty are associated with engineering/health programs and 169 (43%) full and 227 (58%) part-time faculty are working in education/ecology programs. In several programs, a number of departments supply faculty to teach various courses in the composite programs.

When asked how they remain current in their field, faculty responses were largely the same--journals, professional meetings, and consulting. A number of contact persons noted the difficulty of keeping abreast of the rapid changes in the environmental field and observed the need for periodic, easily obtainable up-dates on environmental research and regulations.

D. CURRICULA

Programs in the Engineering/Health section prepare students in at least two of the eight environmental areas surveyed in Phase II (air, energy, noise, pesticides, potable water, radiation, solid waste, and wastewater). The emphasis of the programs is primarily technical and/or scientific and, as reflected in the section heading, geared to environmental engineering and environmental health coursework. The Education/Ecology programs train students for social, educational, political, ecological, managerial, and sytems positions within the environmental workforce. The curricular emphases of both sections are not easily isolated, and the assignment of programs to a particular section is subjective.

Curriculum flexibility, as measured by the amount of time needed to implement a new course or program, gives some indication of the capacity of the educational community to meet changing employment needs. In response to questions regarding this flexibility, contact persons reported that new courses can usually be implemented in one month to one year while program changes may take slightly longer. Answers to these questions were often conditional and dependent on the availability of faculty time and financial resources, departmental and institutional support, and the preparation readiness of course syllabi and materials.

Contact persons made several comments on existing curriculum materials and suggestions for improving instructional aids. They noted that training materials are often "too specific or too general" or "too sophisticated for two-year training programs." Contact personnel asked for curriculum aids that integrate Environmental Studies subjects, more visual aids, and more laboratory equipment. There is some concern that some equipment purchased with federal grant monies must now be returned to the government upon completion of the grant, thus limiting the continuation of research projects.

A concern of professionals in the environmental workforce is that graduates are weak in communication and financial management skills.

Engineering/Health and Education/Ecology program personnel surveyed in Phase II basically agree with this assessment but argue that the same concern applies to all students regardless of discipline. Programs typically require some communication training (writing and speaking) in both formal and informal settings. Financial management skills are usually developed in less structured ways than actural coursework, and according to some contacts, are not necessary prerequisites for sub-managerial employment.

To provide students with a practical working experience related to their classroom and laboratory training, 29% of the Engineering/Health and 59% of the Education/Ecology degree programs offer internships or applied study terms. These experiences not only prepare students for real-world employment but may facilitate job placement. Salaries paid for work under these instructional programs are also a means of financial aid.

E. RESEARCH FUNDING AND SOURCES OF STUDENT FINANCIAL SUPPORT

The financial stability of environmental programs is often a key to their success or demise. Monies for research and student financial aid enable programs to attract faculty and students. Federal and state agencies, private corporations, regional study commissions, and other entities provide important researcy funding to many of the programs surveyed in Phase II. Curriculum changes, additional faculty lines, laboratory materials, and salary increments cost money; and environmental programs are looking more and more to the federal government for support.

Student financial aid packages typically include scholarships; federal, state, and campus loan programs; college work study; and part-time employment outside the university. A majority of graduate students in many of the programs are employed by their departments as teaching or research assistants or as support personnel on program grants or contracts. Traineeships, such as those from the Environmental Protection Agency and the National Institute of Occupational Safety and Health, are an important means of support for those programs fortunate enough to receive them; many other contacts note the negative impact the loss of these traineeships has had on the stability of their programs.

F. EMPLOYMENT

Contact personnel were asked what percentage of their program graduates are employed in industry, consulting, government, or other fields (teaching positions, etc.). The following tables summarize these results nationally.

Industry and government appear to draw greater numbers of Engineering/Health and Education/Ecology program graduates than do consulting firms and various educational institutions. The high percentage of graduates entering government work is not surprising given the emphasis placed on environmental regulation, assessment, and protection by the public sector. Likewise, government mandates have forced industry to take steps in combating pollution and precipitated employment opportunities in this area. Declines in public school enrollment and fiscal constraints at all levels have contributed to decreasing numbers of jobs in the educational community.

COMPOSITE PROGRAMS

NATIONAL EMPLOYMENT PROFILE

Degree	Private Sector Industry	Consulting	Total	Government	Other
Diploma	1%	0%	1%	99%	0%
Associate	32%	11%	43%	54%	2%
Bachelors	34%	12%	46%	42%	11%
Masters	26%	23%	49%	38%	13%
E.E.	58%	11%	69%	27%	3%
Doctoral	27%	28%	55%	31%	14%
TOTAL	31%	16%	47%	41%	12%

In an attempt to identify more specifically those occupations which Engineering/Health and Education/Ecology graduates are qualified to fill, survey participants were asked to check on a prepared form those jobs that graduates of a given degree are trained to assume. Occupations most often cited were:

Composite

Degree Level	Occupations
Certificate	Air Pollution Control Technician
	Environmental Monitoring Specialist
	Regulatory Specialist
	Sanitary Technician
	Solid Waste Collection Operator
	Vector Control Specialist
Associate	Biological Technician
	Environmental Tester/Analyst
	Sanitary Technician
Bachelors	Ecologist
	Environmental Engineering (Water Pollution Control) (Water Resources)
	Environmental Science Technician
	Industrial Waste Inspector
Masters	Chemist
	Environmental Engineer (Water Pollution Control) (Water Resources)
	Pollution Control Specialist
	Sanitary Engineer
Environmental Engineering	Air Pollution Analyst
	Air Pollution Control Engineer
	Environmental Control Engineer
	Environmental Engineer (Water Pollution Control) (Water Resources)
Doctoral	Aerosol Physicist
	Aquatic Biologist
	Bacteriologist
	Chemist
	Environmental Engineer (Water Pollution Control)
	Microbiologist
	Pollution Control Specialist

PROJECT BACKGROUND

Photo reprinted from the University of Wisconsin, Madison Oceanography and Limnology Catalog

PROJECT BACKGROUND

OVERVIEW:

In late 1975, Congress acknowledged the growing national concern for the preservation and conservation of our national resources with a direct inquiry into the availability and readiness of our environmental workforce. That inquiry has taken the form of a three-year, three-phase National Environmental/Energy Workforce Assessment, currently being conducted by National Field Research Center under the direction of the U.S. Environmental Protection Agency. In keeping with the objective of the assessment, this three-phase national effort directs itself at environmental/energy workforce needs, national educational preparedness, and the functional relationship between the two.

PHASE I:

Phase I of the National Environmental/Energy Workforce Assessment focused upon the development of "workforce demand projections" through 1982 for all public environmental agencies. This on-site assessment, which was carried out in all 50 states, Puerto Rico and the Virgin Islands, culminated in a numerical profile of the growth patterns and workforce needs at the national and state levels. Stratification of the overall definition of "environmental occupation" into seven distinct vocational areas enhanced even further the applicability of the results. In addition to this public sector workforce assessment, Phase I included an overview analysis of private sector needs (through an adjunct mail survey of selected businesses and industries) and a brief review of selected environmental educational programs.

Phase I was completed in May, 1977. The 70-volume final report included:

* National Abstract	(1)
* National Legislation	(1)
* Regional Assessments	(10)
* State Assessments (including D.C., VI and PR)	(53)
* Business and Industry Assessment	(1)
* National Summary	(4)

PHASE II:

Phase II of the National Environmental/Energy Workforce Assessment was structured around an intensive on-site inventory of representative environmental educational offerings on a national scale. The primary objective of this project has been to collect and aggregate data on training and educational programs in both the post-secondary education field and in the private sector and to do so by environmental area. Specifically, the study was designed to provide an overview of environmentally related post-secondary education programs, their program structure, representative course offerings, employment history of the graduates, and the faculty structure. Additionally, information was to be collected on program requirements and program projections.

Initially, opportunities to nominate programs for inclusion in this on-site review process was given to the Environmental Protection Agency and its program officers and regional personnel both through the

Project Officer and via direct mail requests; all state departments of education; state environmental agencies and selected media-specific associations. These nominations were supplemented by a direct review of institutional catalogs, information obtained during the first year's on-site activities, and a review of other published sources of information regarding degree programs in environmental areas. These sources are included in Appendix III - Selected Bibliography.

Following their initial development, the lists of nominees were forwarded to the program officers for suggestions regarding additions or deletions. Next, letters were written to those nominated institutions seeking their support and cooperation in the on-site review process. Several programs, some of which were highly recommended, declined the opportunity to participate giving reasons varying from lack of time to the fact that the program being inquired about no longer existed, to outright refusal to cooperate with any government study. These institutions were deleted from the final on-site process. The remainder were included in the study and are shown in Table 1 of each volume. Selection of the sample for the private sector is discussed in depth in that particular volume.

In preparation for the on-site interviews, appropriate persons were contacted in the institution involved and were given a background description of the study, a suggested timetable for the interview process and were told what kind of information was being sought. This was all done in an effort to keep the time involvement of the individual contact persons at a minimum. During the actual on-site interview, generally lasting around one hour, the information was collected, questions asked and answered, and further informational contacts identified. Following this process, each on-site interview was written up in the form of a Training Program Summary, which where time allowed, was returned to the contact person for critiquing prior to inclusion in the report.

Throughout this process, individuals and institutions were given assurance that this study was not an attempt to evaluate program offerings and every attempt has been made on the part of the writers to live up to this assurance. Inclusion in this report provides no assurances of quality, nor should a program's exclusion be consideration of the lack thereof. In many instances certain programs within an institution were not included while others were, primarily due to the determination of the sample - previously discussed. This too should not be viewed in any qualitative manner.

REPORT ORGANIZATION:

The final report, of which this volume is a part, consists of volumes depicting a training profile in each medium under consideration; namely,

Air
Energy
Noise
Pesticides
Potable Water
Radiation
Solid Waste
Wastewater
Composite
Business and Industry and Trade Associations

At the outset it should be pointed out that there are very few degree programs conveying degrees in a particular medium; rather, degrees are offered in various specialties which lend themselves to obtaining employment in one or more of these fields. Nonetheless, to obtain maximum utility for the funding agency, programs were reported in this fashion. The Composite section was necessitated by the number of programs offering course work in multiple fields and differing specializations resulting from course selection. For convenience in handling of the data Potable Water, Wastewater and Composite have been reported in multiple volumes because of the numbers involved. Although separated into volumes either by degree level of the programs involved, as in the case of Potable Water and Wastewater, or by content as in the case of Composite, persons interested in any of these fields would be well advised to review each of the volumes to assure more complete coverage.

Along with the standard introductory pages common to volumes of this nature, each volume contains sections on Project Background, Introduction (consisting of sections devoted to a description of the programs surveyed and covered in the volume), Project Commentary, and the Training Summaries along with the Appendices.

REVIEW PROCESS:

In addition to individual training summary reviews conducted by the persons initially interviewed, each volume has been reviewed internally, by persons in the Environmental Protection Agency and by a select group of review committee members. In the final instance, individuals met during the on-site process were nominated by interviewers for inclusion on the review committee, primarily as a result of their obvious expertise in the field and their evidenced interest in the project.

These persons were then contacted by mail or by telephone in an effort to determine their willingness to serve. The rather stringent timelines necessary to keep the project on course and to deliver the finished product as specified were also detailed. In excess of one hundred persons returned their volumes (out of a mailing of 120) and all but five of these provided usable responses. In these five instances either last minute job demands prevented them from carrying out the review in the short timelines, or (in two instances) individuals indicated that they wanted nothing to do with the process. This particular method of review provided a wealth of valuable information, suggestions for revision of specific elements, and general comments helpful in revising the final documents. In all cases an effort was made to seriously consider and incorporate reviewer suggestions. The persons on the various review committees are individually acknowledged in the front of the volume they reviewed.

Photo reprinted from the University of Missouri, Columbia Bulletin 1977.

INTRODUCTION

Photo reprinted from the Northland College Catalog 1975-76

INTRODUCTION

Phase II of the National Environmental/Energy Workforce Assessment Project was designed to tap the capability of the educational community to generate an environmental workforce. The resulting Post-Secondary Education Profile identified and gathered information concerning representative training programs in a variety of environmental areas: air, energy, noise, pesticides, potable water, radiation, solid waste, and wastewater. At the onset, it became readily apparent that some environmental programs do not fit neatly into any single category: they may fit more than one or none at all. Nonetheless, these programs produce environmentally aware and environmentally skilled graduates who then enter our national workforce. In order to include these unique or umbrella programs, a category labeled COMPOSITE was created.

Subsequent review of the structure, objectives and goals, and course requirements and descriptions for each composite program suggested the feasibility of further dividing these programs into two sections. The first section--Environmental Engineering/Health--contains those programs which prepare students for predominately technical, engineering, or environmental health occupations. Curriculum options, areas of specialization or concentration, and coursework, by the very nature of the composite designation, reflect at least two of the environmental areas surveyed in this Workforce Assessment Project. The second section--Environmental Education/Ecology--contains programs that train students for social, educational, political, ecological, managerial, and systems positions within the environmental workforce. While students enrolled in these Education/Ecology programs may receive extensive technical training, their plans of study incorporate the social and behavioral sciences, resource management and policy, and training in the integration of disciplines in solving environmental problems.

The sectional placement of a given composite program was essentially based on a subjective assessment of that program's commonality with other programs in Engineering/Health and in Education/Ecology. As such, the identification of programs as either Engineering/Health or Education/Ecology is subject to question. The purpose of dividing these composite programs, however, was not to attain a high degree of inter-rater reliability but to permit a potentially more interpretable data set. For a more complete understanding of the type of programs included in each composite section, one should consult the individual program summaries contained in the two volumes titled Engineering/Health and the single volume titled Education/Ecology.

Given these definitional considerations, the survey responses from contact personnel in Environmental Education/Ecology programs regarding student enrollment and recruitment, employment and follow-up of graduates, research activity and support, faculty numbers, curriculum projections, and funding needs are presented and discussed in the pages that follow. Responses are compiled nationally, and by degree level. While sample size and sampling error limit the generalizability of these results, some attempt is made to summarize the general implications of the project for training programs in Environmental Education, Ecology, and related areas.

TABLE I

PARTICIPATING INSTITUTIONS

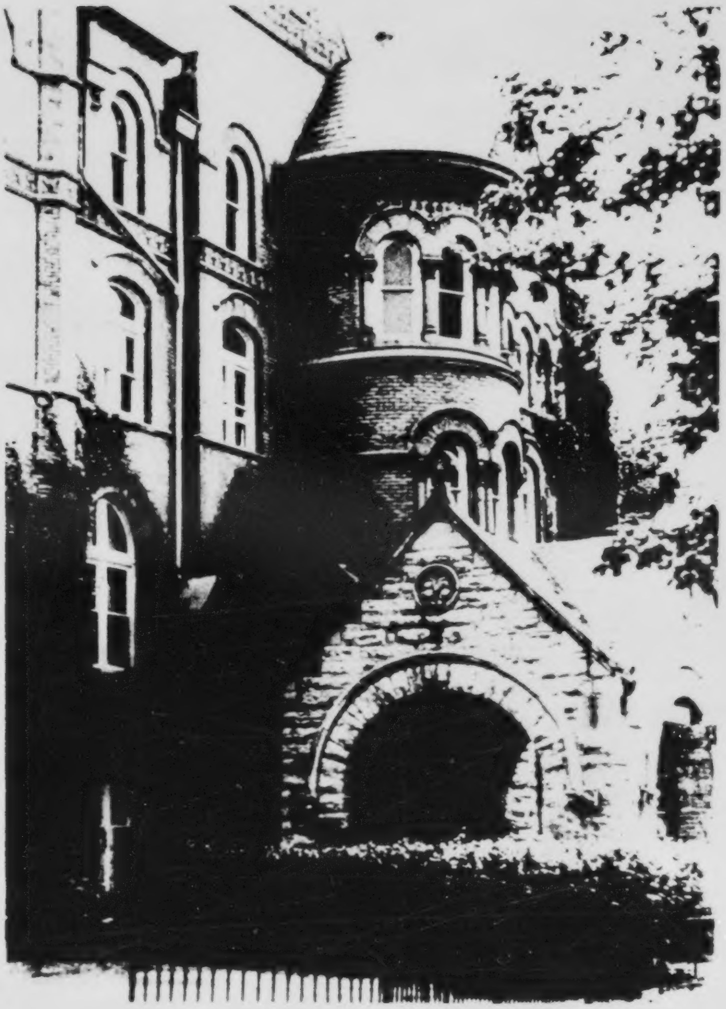

Photo reprinted from the Macalester College 1976-78 Catalog

Table 1 is a comprehensive listing of all institutions which participated in the post-secondary educational profile of the National Environmental/Energy Workforce Assessment. Listed by state, institution, and degree are programs surveyed in the areas of air, energy, noise, pesticides, potable water, radiation, solid waste and wastewater.

An explanation of the degree abbreviations utilized within the report may be found in Appendix I, entitled "Degree Abbreviations". For a complete listing of the institutions visited in a media specific area (i.e., air, energy, etc.), attention is drawn to Appendix IV, entitled "Participating Institutions by Environmental Category".

The Table in part III of the Project Findings, entitled "A Summary Profile of Representative Educational Programs" follows the narrative and is a presentation of specific institutions visited for the particular volume.

TABLE I

PARTICIPATING INSTITUTIONS

STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)*
AL	University of Alabama University	Environmental Engineering	M.S. (3)
AK	University of Alaska Fairbanks	Environmental Quality Engineering Science	M.S.
AR	University of Arkansas Fayetteville	Agricultural Engineering	B.S. M.S. Ph.D.
		Civil Engineering	M.S.C.E.
		Environmental Engineering	M.S.En.E.
		Environmental Science	B.S.
CA	California Institute of Technology Pasadena	Environmental Engineering Science	M.S. Ph.D.
	California Polytechnic State University San Luis Obispo	Environmental Engineering	B.S.
	California State University-Sacramento Sacramento	Civil and Environmental Engineering	B.S. M.S.
	Stanford University Stanford	Environmental and Water Studies	M.S. Ph.D.
	University of California-Berkeley Berkeley	Nuclear Engineering	B.S. M.S. M.E. Ph.D. D.E.
		Pest Management	B.S.
		Sanitary Engineering	M.S. M.E. Ph.D.
	University of California-Davis Davis	Environmental Toxicology	B.S.
		Plant Protection and Pest Management	M.S.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	University of California-Davis (Cont'd)	Entomology	B.S. M.S. Ph.D.
	University of California-Riverside Riverside	Pest Management	M.S.
	University of California-Santa Barbara Santa Barbara	Environmental Studies	B.A.
CO	Colorado State University Fort Collins	Environmental Engineering (Civil)	M.S. Ph.D.
	Community College of Denver-Red Rocks Golden	Water-Wastewater Technology	A.A.
CT	Hartford State Technical College Hartford	Nuclear Engineering Technology	A.S.
	Yale University New Haven	Environmental Health	M.P.H.
DE	Delaware Technical and Community College Newark	Environmental Engineering Technology	A.A.S.
	University of Delaware Newark	Entomology and Applied Ecology	B.S.
		Environmental Engineering	M.A.S. M.E. Ph.D.(App. Science) Ph.D.(ChE)
DC	Catholic University Washington	Civil Engineering	B.S.
	Howard University	Environmental Engineering	M.E.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
FL	Broward Community College Fort Lauderdale	Pest Control Technology	A.S.
	Central Florida Community College Ocala	Radiological Health Technology	A.S.
	Florida International University Miami	Environmental Studies	B.A. B.S.
		Environmental Engineering Technology	B.S.
	Heed University Hollywood	Ocean and Environmental Affairs	M.A. Ph.D.
	Miami-Dade Community College Miami	Environmental Engineering Technology	A.S.
		Marine Science Technology	A.S.
	University of Florida Gainesville	Air Pollution	M.E. M.S. Engineer Ph.D.
		Environmental Biology	M.E. M.S. Engineer Ph.D.
		Environmental Resources Management Activities	M.E. M.S. Engineer Ph.D.
		Systems Ecology	M.E. M.S. Engineer Ph.D.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	University of Florida (Cont'd)	Water Supply and Water Pollution Control	M.E. M.S. Engineer Ph.D.
		Nuclear Engineering	B.S.(N.E.) B.S.E.(N.E.) M.E. M.S. Engineer Ph.D.
		Radiological Sciences	M.E. M.S.
	University of Miami Miami	Marine and Atmospheric Science	M.S. Ph.D.
GA	Abraham Baldwin Agricultural College Tifton	Plant Protection	A.Ag.
	Atlanta University Center/ Georgia Institute of Technology Atlanta	Water Pollution Control Design Engineering	B.S. B.E.
	Georgia Institute of Technology Atlanta	Acoustical Engineering	Advanced Cert.
		Energy Engineering	Advanced Cert.
		Environmental Studies	Advanced Cert.
	Southern Technical Institute Marietta	Nuclear Safety	A.S.
	University of Georgia Athens	Entomology	B.S. A.B. M.S. M.P.P.P.M. Ph.D.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	University of Georgia (Cont'd)	Environmental Health Science	B.S.E.H.
HI	University of Hawaii Honolulu	Environmental and Sanitary Engineering	M.S.
IL	Illinois Institute of Technology Chicago	Environmental Engineering	B.S.E.S. M.S. Ph.D.
	Prairie State Community College Chicago Heights	Air, Water, Wastewater	A.A.S.
	Sangamon State University Springfield	Environments and People	B.A. M.A.
	Southern Illinois University-Edwardsville Edwardsville	Wastewater Treatment Operator Training	Cert.
IN	Indiana University Bloomington	Environmental Programs	Cert. A.S. B.A. B.S. M.P.A. M.S.E.S. Ph.D. (minor)
	Purdue University West Lafayette	Environmental Sciences Option	B.S.
		Nuclear Engineering	B.S.N.E. M.S. Ph.D.
IA	Iowa State University Ames	Environmental Studies	B.A. B.S.
		Sanitary Engineering and Water Resources	M.S. Ph.D.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	Kirkwood Community College Cedar Rapids	Environmental Health Assistant	Diploma
		Environmental Health Technician	A.A.
		Water and Wastewater	Diploma
	University of Iowa Iowa City	Environmental Engineering	M.S. Ph.D.
		Environmental Toxicology	M.S. Ph.D.
KS	Kansas State University Manhattan	Chemical Engineering	B.S. M.S. Ph.D.
		Mechanical Engineering	B.S. M.S. Ph.D.
		Nuclear Engineering	B.S. M.S. Ph.D.
		Sanitary Engineering	M.S.C.E.
	University of Kansas Lawrence	Environmental Health Engineering	M.S. Ph.D.
		Environmental Health Science	M.S. Ph.D.
		Environmental Studies	B.A.
		Radiation Biophysics	B.A. B.S. M.S. Ph.D.
		Water Resources Engineering and Science	M.S. Ph.D.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
KY	Morehead State University Morehead	Environmental Studies	B.S. A.B.
		Mining Technology	A.A.S.
	Pikeville College Pikeville	Mining Technology	A.M.T.
	University of Kentucky Lexington	Energy (Coal) Engineering	M.S. Ph.D.
		Environmental Engineering	M.S. Ph.D.
	University of Louisville Louisville	Environmental Engineering	B.S. M.Eng.
	Western Kentucky University Bowling Green	Environmental Science	B.S.
		Environmental Engineering	B.S.
LA	Delgado College New Orleans	Urban Pest Management	A.S.
		Water/Wastewater Technology	A.S.
		Environmental Health Technology	A.S.
	McNeese State University Lake Charles	Environmental Science	B.S. M.S.
ME	Eastern Maine Vocational Technical Institute Bangor	Environmental Control Technology	A.A.S.
	New England Regional Wastewater Institute (S. Maine Vocational Technical Institute) S. Portland	Wastewater Treatment Technology	Cert.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	University of Maine-Orono Orono	Sanitary Engineering	M.S.C.E. Ph.D.
MD	Charles County Community College La Plata	Pollution Abatement Technology	A.A.
	Johns Hopkins University Baltimore	Environmental Engineering	M.A. M.S.E. M.S. Ph.D
	University of Maryland College Park	Environmental Engineering	M.S.
		Nuclear Engineering	M.S.
		Pest Management	M.S.
MA	Harvard University Cambridge	Environmental Health Sciences	S.M. Sc.D.
		Environmental Sciences and Engineering	S.M. M.E. Ph.D.
		Toxicology	S.M. Sc.D.
	Massachusetts Institute of Technology Cambridge	Acoustics	S.M. Sc.D./ Ph.D.
		Environmental Engineering	Env.E.
		Mineral Resources Engineering and Management	S.M. Engr. Sc.D./ Ph.D.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	Massachusetts Institute of Technology (Cont'd)	Nuclear Engineering	S.B. S.M. N.E. Sc.D./Ph.D.
		Water Resources and Environmental Engineering	S.B. S.M. Sc.D./Ph.D.
		Wastewater Treatment Plant Operations	Cert.
	Northeastern University Boston	Environmental Engineering and Science	M.S.
	Springfield Technical Community College Springfield	Environmental Technician	A.S.
	Tufts University Medford	Environmental Health Engineering	B.S.C.E. M.S.
	University of Lowell Lowell	Radiological Health Physics/Radiological Sciences and Protection	B.S. M.S.
		Wastewater Treatment Plant Operations	Cert.
MI	Ferris State College Big Rapids	Environmental Health Technician	A.A.S.
		Environmental Health	B.S.
	Michigan State University East Lansing	Environmental Conservation Education	M.S. Ph.D.
		Environmental Engineering	B.S.C.E. M.S. (emphasis) Ph.D. (emphasis)

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	Michigan State University (Cont'd)	Natural Resources and Environmental Education	B.S.
		Systems Science (Ecological Systems)	B.S. M.S. Ph.D.
	Michigan Technological University Houghton	Environmental Engineering	B.S.C.E. B.S.E. M.S.C.E.
	University of Michigan Ann Arbor	Environmental Education	M.S.
		Environmental Sciences Engineering	B.S.
		Industrial Hygiene and Air Pollution	M.P.H. M.S. Dr.P.H. Ph.D.
		Radiological Health	M.P.H. M.S. Dr.P.H. Ph.D.
		Water Resources: Engineering	M.S.E. Ph.D.
		Management Science	M.S. Ph.D.
		Water Quality	M.P.H. M.S. Dr.P.H. Ph.D.
MN	Bemedji State College Bemedji	Environmental Studies	B.S. M.A.
	Macalester College St. Paul	Environmental Studies	B.A. B.S.
	University of Minnesota Minneapolis	Environmental Health	M.P.H. M.S. Ph.D.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
MS	Mississippi State University Mississippi State	Specialized Training in Pest Management	M.Ag.
MO	Missouri Southern State College Joplin	Environmental Health Technology	A.S. B.S.
		Radiologic Technology	A.S.
	St. Louis Community College at Forest Park St. Louis	Radiologic Technology	A.S.
	University of Missouri-Columbia Columbia	Sanitary Engineering	B.S. M.S. Ph.D.
	University of Missouri-Rolla Rolla	Environmental and Sanitary Engineering	M.S. Ph.D.
	Water and Wastewater Technical School Neosho	Water and Wastewater Training	Cert.
	Washington University St. Louis	Air (emphasis)	M.S. D.Sc.
MT	Montana State University Bozeman	Environmental Engineering	M.S.
		Environmental Health Technology	M.S.
	Northern Montana College Havre	Environmental Health Technology	A.A. Cert.
NE	Central Technical Community College Hastings	Agriculture Technology	Cert. 1-Year Diploma 2-Year Diploma A.A.S. A.S.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	University of Nebraska Lincoln	Sanitary Engineering	B.S. M.S. Ph.D.
		Water Resources Engineering	M.S.
		Planning and Management	M.S.
NH	University of New Hampshire Durham	Entomology	B.S. B.A.
NJ	Middlesex County College Edison	Environmental Health Science Technology	A.A.S.
	New Jersey Institute of Technology Newark	Interdisciplinary Studies in Environmental Engineering	M.S.
	Princeton University Princeton	Energy Conversion and Resources	Topical Programs
	Rutgers-SUNJ New Brunswick	Biology (option in entomology)	B.S. B.A.
		Entomology and Economic Zoology	M.S. M.P. Ph.D.
		Environmental and Business Economics	B.S.
		Environmental Science	M.S. Ph.D.
		Environmental Studies	B.S.
		Environmental and Water Resources Engineering	M.S. Ph.D.
		International Environmental Studies	B.A. B.S.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	Rutgers-SUNJ (Cont'd)	Radiation Sciences	M.S. Ph.D.
	Stevens Institute of Technology Hoboken	Air Pollution Control Engineering	Cert.
		Water and Wastewater Engineering	Cert.
NM	New Mexico State University Las Cruces	Pest Management	B.S.
	University of New Mexico Albuquerque	Nuclear Engineering	M.S. Ph.D.
NY	Clarkson College Potsdam	Civil and Environmental Engineering	B.S. M.S.
	Columbia University New York City	Nuclear Engineering	B.S. M.S. Nuc.Engr. Eng.Sc.D.
	Cornell University Ithaca	College Program in Energy Conversion	B.S.
		Environmental Engineering	B.S. M.S. M.Eng. Ph.D.
		Waste Management Engineering	M.S. M.Eng. M.P.S. Ph.D.
		Nuclear Engineering	M.Eng. M.S. Ph.D.
	Hofstra University Hempstead	Solid Waste Management	Cert.
	Hudson Valley Community College Troy	Public Health Technology (Environmental option)	A.A.S.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	Hunter College New York City	Environmental Health Science	B.S. M.S.
	Manhattan College New York City	Environmental Engineering and Science	M.S. M.E.
	Polytechnic Institute of New York New York City	Energy Engineering and Policy	Cert. M.S.
		Environmental Engineering and Planning	M.S.C.E. M.E.H.S. Engr. Ph.D.
	Rensselaer Polytechnic Institute Troy	Environmental Engineering	B.S. M.E. M.S. D.E. Ph.D.
		Nuclear Engineering	B.S. M.S. M.E. Ph.D.
	Rochester Institute of Technology Rochester	Civil Engineering Technology (Environmental option)	B.T.
	State University of New York-Buffalo Buffalo	Water Resources and Environmental Engineering	B.S. M.S. Ph.D.
	State University of New York Farmingdale	Pest Control Technology	A.A.S.
	Syracuse University Syracuse	Chemical Engineering	B.S. M.S. Ph.D.
		Environmental Engineering	B.S.
		Sanitary Engineering, Sanitary Science, Civil Engineering	M.S.(S.E.) M.S.(S.S.) Ph.D.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	The Cooper Union New York City	Integrated Master's Program with concentration in Environmental Engineering	M.E.
	Ulster County Community College Stone Ridge	Water Quality Management Training	A.A.S.
	University of Rochester Rochester	Toxicology Training Program	M.S. Ph.D.
NC	Duke University Durham	Environmental Management	M.E.M.
		Civil Engineering/ Urban and Environmental Engineering	M.S. Ph.D.
	North Carolina State University Raleigh	Agricultural Pest Control	A.A.S.
		Pest Management	B.S. M.S. (minor)
		Air Conservation	M.S. (minor) M.E. (minor) Ph.D.(minor)
		Environmental Engineering	M.S. M.C.E. Ph.D.
		Acoustic, Noise Vibration	M.S. M.M.E. Ph.D.
	University of North Carolina Chapel Hill	Air and Industrial Hygiene	M.S. M.S.P.H.
		Environmental Chemistry and Biology	M.S. M.S.P.H. Ph.D.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	University of North Carolina (Cont'd)	Environmental Management Protection	M.S. M.S.P.H. Ph.D.
		Radiological Hygiene	M.S. M.S.P.H. Ph.D.
		Water Resources Engineering	M.S. M.S.P.H. M.S.E.E. Ph.D.
	Wilson County Technical Institute Wilson	Sanitary Landfill Operating Manager	Cert. Diploma A.A.S.
		Sanitary Landfill Technology	A.A.S.
ND	North Dakota State School of Science Wahpeton	Environmental Science Technology	A.A.
OH	Antioch College Yellow Springs	Environmental Studies	B.S.
	Hocking Technical College Nelsonville	Environmental Health Technology	A.A.S.
	Miami University Oxford	Environmental Science	M.En.
	Muskingum Area Technical College Zanesville	Environmental Quality Control Technology	A.A.S.
		Natural Resources Conservation Technology	A.A.S.
		Petroleum Engineering Technology	1-Year Cert. A.A.S.
	Ohio State University Columbus	Agricultural Engineering	B.S. M.S. Ph.D.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	Ohio State University (Cont'd)	Chemical Engineering (air)	B.S. M.S. Ph.D.
		Civil Engineering	B.S. M.S. Ph.D.
		Environmental Biology	M.S. Ph.D.
		Environmental Education	B.S.(Ed.) B.S.(N.R.) M.S. Ph.D.
		Toxicology (Pharmacology)	M.S. Ph.D.
	Ohio University Athens	Environmental Studies	M.S.
	Raymond Walters General and Technical College (University of Cincinnati) Cincinnati	Environmental Control/ Protection Technology	A.S.
	University of Cincinnati Cincinnati	Air Pollution and Industrial Hygiene	M.S. Ph.D.
		Civil and Environmental Engineering	M.S. Ph.D.
		Environmental Health	M.S. Ph.D.
		Mechanical and Industrial Engineering (noise)	B.S. M.S. Ph.D.
		Occupational Medicine	M.S. Ph.D.
		Toxicology	M.S. Ph.D.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	University of Cincinnati (Cont'd)	Acoustics and Noise Control	B.S. M.S. Ph.D.
	University of Toledo Toledo	Chemical Engineering, Civil Engineering	B.S. M.S.
		Engineering Science	M.S.
OK	East Central Oklahoma State University Ada	Environmental Science	B.S.
	OSU Oklahoma City Technical Institute Oklahoma City	Civil Technology	A.S.
	Oklahoma State University Stillwater	Engineering Technology	A.D. B.S.
		Radiation and Nuclear Engineering Technology	A.D. B.S.
	Oscar Rose Junior College Midwest City	Wastewater Technology	A.A.S.
		Environmental Science	A.A.S.
	University of Oklahoma Norman	Environmental Science	B.S. M.S. Ph.D.
OR	Linn-Benton Community College Albany	Wastewater Technology	A.S.
		Water/Wastewater Technology	A.S.
		Water/Wastewater Plant Operator	Cert.
	Oregon Institute of Technology Klamath Falls	Environmental Technology	A.A.S. B.T.
	Oregon State University Corvallis	Nuclear Engineering Technology	B.S.
		Nuclear Engineering	B.S. M.S.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	Oregon State University (Cont'd)	Pest Management and Plant Pathology	B.S. M.S.
	Portland State University Portland	Engineering and Applied Science	B.S. M.S.
PA	Carnegie-Mellon University Carnegie Institute of Technology Pittsburgh	Environmental Engineering	B.S. M.S. Ph.D.
	Drexel University Philadelphia	Environmental Engineering and Science	M.S.E.E. M.S.E.S. Ph.D.
	Pennsylvania State University University Park	Acoustics	M.E. M.S. Ph.D.
		Air Pollution Control Technology	A.A.P.C.T.
		Entomology	B.S. M.Agr. M.S. Ph.D.
		Environmental Engineering	B.S. M.S. M.E.E.E. Ph.D.
		Environmental Pollution Control	M.S. M.E.P.C. M.E.
		Environmental Resource Management	B.S.
		Minerals Processing	M.S. Ph.D.
		Mining Technology	A.A.S.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	Pennsylvania State University (Cont'd)	Mining Engineering	B.S. M.S. M.E. Ph.D.
		Nuclear Engineering Technology	A.N.E.T.
		Nuclear Engineering	B.S. M.S. M.E. Ph.D.
		Petroleum and Natural Gas Engineering	B.S. M.S. Ph.D.
		Water Resources Engineering Technology	B.T.
	Slippery Rock State College Slippery Rock	Environmental Studies	B.S.
	Temple University Philadelphia	Environmental Technology	A.T.
		Environmental Engineering Technology	B.S.
	University of Pennsylvania Philadelphia	Energy Engineering	M.S.E.
		Energy Management and Policy	M.S.E.M.P. Ph.D.
	University of Pittsburgh Pittsburgh	Environmental and Sanitary Engineering	B.S. M.S. Ph.D.
		Environmental Systems Engineering	degrees granted through Engr. Dept.
	School of Public Health (University of Pittsburgh) Pittsburgh	Acoustic Environmental Control	M.S.(Hyg.) D.S.(Hyg.)
		Air Resources	M.S.(Hyg.)

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	School of Public Health (University of Pittsburgh) (Cont'd)	Environmental Health Engineering	M.P.H. D.S.(Hyg.)
		Environmental Health Planning	D.S.(Hyg.)
		Health Aspects of Water Quality	M.S.(Hyg.)
		Industrial Hygiene	M.S.(Hyg.)
		Toxicology	D.S.(Hyg.) Ph.D.
		Radiation Health	M.S.(Hyg.) D.S.(Hyg.) Ph.D. D.P.H.
RI	University of Rhode Island Kingston	Environmental Engineering	B.S. M.S. Ph.D.
SC	Clemson University Clemson	Air Pollution	M.S. M.Engr.
		Natural Systems	M.S. M.Engr.
		Planning and Management	M.S. M.Engr.
		Water Treatment Systems	M.S. M.Engr.
		Environmental Systems Engineering	Ph.D.
	Greenville Technical College Greenville	Wastewater Technology	A.A.S.
	Sumter Area Technical College Sumter	Environmental Engineering Technology	A.E.T.
TN	Chattanooga State Technical Community College Chattanooga	Environmental Science Technology	A.S.
		Nuclear Technology	A.S.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	East Tennessee State University Johnson City	Environmental Health	B.S.E.H. M.S.E.H.
	Memphis State University Memphis	Audiology	M.A. Ph.D.
	Middle Tennessee State University Murfreesboro	Environmental Science and Technology	B.S.
	State Technical Institute at Memphis Memphis	Environmental Engineering Technology	A.E.
	University of Tennessee Knoxville	Environmental Engineering	M.S.E.E. M.E. Ph.D.
		Environmental Engineering (Air Quality and Pollution Control)	M.S.E.E. M.E. Ph.D.
		Environmental Engineering (Water Pollution Control/ Water Resources)	M.S.E.E. M.E. Ph.D.
		Industrial Audiology	M.A.
		Nuclear Engineering	B.S. M.E. M.S. Ph.D.
		Water Resources Development	M.S.
	Vanderbilt University Nashville	Environmental and Water Resources Engineering (EWRE)	B.E.
		Environmental Science	B.S.
		EWRE (Environmental Science)	M.S. M.Eng. Ph.D.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	Vanderbilt University (Cont'd)	EWRE (Air Resources)	M.S. M.Eng. Ph.D.
		EWRE (Solid Waste)	M.S. M.Eng. Ph.D.
		EWRE (Water and Wastewater Treatment/Water Resources)	M.S. M.Eng. Ph.D.
TX	Baylor University Waco	Institute of Environmental Studies	B.A. B.S.
	Lamar University Beaumont	Environmental Science	B.S.
		Energy Resource Management	B.S.
	Rice University Houston	Environmental Science and Engineering	M.S.
	Sam Houston State University Huntsville	Environmental Science	B.S.
	Texas A & M University College Station	Environmental Engineering	M.S. Ph.D.
		Entomology	M.S.
		Entomology/Pest Management Option	M. Ag.
	Texas State Technical Institution Waco	Nuclear Technology	A.A.S.
		Water/Wastewater Technology	A.A.S.
		Water Utility Operator	Certificate
	University of Texas Austin	Environmental Health Engineering	M.S. Ph.D.
		Water Resources Engineering	M.S. Ph.D.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
UT	Brigham Young University Provo	Chemical Engineering	B.S. M.S.
		Water Resources and Environmental Engineering	B.S. M.S.
	University of Utah Salt Lake City	Civil Engineering	B.S. M.E. M.S. Ph.D.
	Utah State University Logan	Civil and Environmental Engineering	B.S. M.S. Ph.D.
		Pest Management	B.S. M.S.
		Environmental Studies	B.S.
VA	George Washington University NASA-Langley Institute Hampton	Acoustics	M.S. Sc.D.
		Environmental Modeling	M.S.
	J.Sargeant Reynolds Community College Richmond	Environmental Technology Environmental Operations	Cert. A.A.S.
		Ground Water Resources	Cert.
	Virginia Polytechnic Institute and State University Blacksburg	Civil Engineering Technology	B.S.
		Sanitary Engineering/Environmental Sciences and Engineering/Civil Engineering	M.S. Ph.D.
	Wytheville Community College Wytheville	Environmental Technology	Cert.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
WA	The Evergreen State College Olympia	Coordinated Studies	B.A.
	University of Washington Seattle	Environmental Studies	B.A. B.S.
		Air Resources	M.S. Ph.D.
	Washington State University Pullman	Environmental Science	B.S. M.S.
		Chemical Engineering	M.S.
		Air Pollution Control Engineering	M.S.
		Air Pollution Science	M.S.
		Air Pollution Option	M.S.
		Air Pollution Program	M.S.
	Western Washington University Bellingham	Environmental Studies	B.S.
WV	Bluefield State College Bluefield	Mining Engineering Technology	A.S. B.S.
	West Virginia Institute of Technology Montgomery	Mining Engineering Technology	A.S.E.M.T. B.E.M.T.
	West Virginia University Morgantown	Engineering of Mines	B.S.
		Environmental Engineering	M.S.C.E. M.S.E.
		Mineral Processing Engineering	B.S. M.S.
		Mineral Resource Economics	M.S.
		Petroleum Engineering	B.S. M.S.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
WI	Marquette University Milwaukee	Environmental Engineering	B.A. B.S.
	Northland College Ashland	Environmental Studies	B.A.
	University of Wisconsin-Green Bay Green Bay	Environmental Emphasis	B.A. B.S. M.E.A.S.
	University of Wisconsin-Madison Madison	Civil and Environmental Engineering	B.S.
		Environmental Communications	M.A. M.S.
		Water Resources Management, Environmental Monitoring, Land Resources	M.S. Ph.D.
	University of Wisconsin-Milwaukee	Atmospheric and Marine Environmental Program	M.S. M.E.
WY	Casper College Casper	Water Quality Technology	A.S.
	University of Wyoming Laramie	Civil Engineering	M.S. Ph.D.

Other Programs

The following programs were included in the on-site visit process and offer training through various institutes, centers, state agencies, or college consortiums. Program descriptions can be found in the volume specified.

State	Institution	Program	Volume
FL	Florida Department of Environmental Regulation	Environmental Noise Control Training	Noise
	Miami-Dade Community College	NPDES Effluent Monitoring Training	Wastewater I
		Wastewater Treatment Plant Operations	Wastewater I
		Water Treatment Plant Operations	Potable Water I
	University of Miami School of Medicine	Pesticide Protection	Pesticides
KS	Kansas State University	Institute for Environmental Research	Composite II III Business and Industry
MI	Michigan State University	Institute of Water Research	Potable Water I
		Pesticide Research Center	Pesticides
NE	University of Mid-America	Pests, Pesticides and Pesticide Safety	Pesticides

State	Institution	Program	Volume
NJ	Princeton University	Environmental Science and Policy	Composite I
NC	U.S. Environmental Protection Agency	Air Pollution Training Institute	Air
OH	Ohio State University	Center for Lake Erie Area Research	Potable Water I
		Cooperative Extension Service Activities	Composite II and III
		Water Resources Center	Potable Water I
PA	Air Pollution Control Association	Refresher, Continuing Education Courses	Air
	University of Pittsburgh	Environmental Systems Engineering	Composite I
TN	Memphis State University	Nuclear Reactor Fundamentals	Energy
		Radiation Technician Training Course	Radiation
	Oak Ridge Associated Universities	Radiation Emergency Assistance Center/ Training Site	Radiation
		Special Training	Energy Radiation
	University of Tennessee Center For Health Sciences	Training Courses in Audiometric Orientation	Noise

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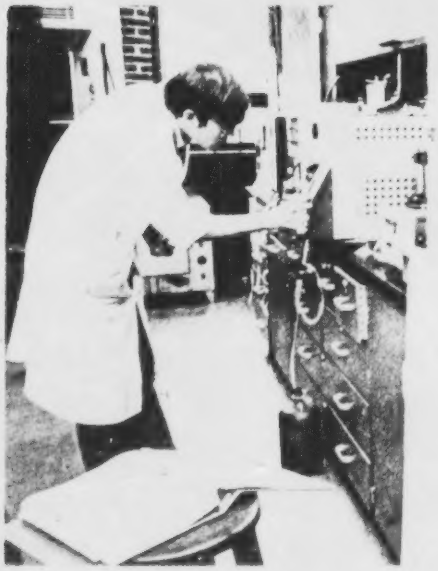
PROJECT FINDINGS



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I. A SUMMARY PROFILE OF REPRESENTATIVE ENVIRONMENTAL EDUCATION/ECOLOGY PROGRAMS

A. States, Institutions, Program, and Degree

The Post-Secondary Education Profile (Phase II) Composite: Education/Ecology includes 37 programs. Originating in 17 states, these programs represent degree offerings from the associate to the doctoral level. They were selected for inclusion in the survey on the basis of information and recommendations obtained during the workforce assessment phase of this three-year project, from institutional catalogs, and from a review of other published sources of information regarding degree programs in environmental areas. Project personnel gathered detailed information concerning these composite programs through on-site interviews and supplementary correspondence and telephone conversations.

Summary statistics discussed in sections below indicate that programs fall predominately in baccalaureate and masters degree levels and are heavily skewed to the mid-west region. These results do not necessarily indicate that Environmental Education and Ecology programs do not exist at the sub-baccalaureate level or in other regions. Rather these results caution against making any strict definitive conclusions regionally or across degree levels. The preponderance of degree programs at the bachelors level is not surprising given that Environmental Education and Ecology programs represent basically generalist training and are not geared to the preparation of associate-degree technicians or specialized environmental scientists trained in graduate research programs.

B. Enrollment Statistics and Graduates

Data regarding numbers of full-time and part-time students and the average number of graduates from the Education/Ecology programs surveyed are reported nationally in Table 2.

Contact personnel report that approximately two-fifths (39 percent) of the composite programs (or degree offerings, in some cases) surveyed are experiencing upward trends in numbers of graduates annually and an additional 59 percent report stable numbers of diplomas conferred over the last few years. These results suggest a constant to growing production rate of environmental workforce personnel in the Environmental Education and Ecology areas from post-secondary institutions.

Responses from contact persons, regarding the enrollment of women, tended to be highly generalized making tabulation and statistical analyses of this item difficult. Comments recorded by interviewers indicate that the percentage of women enrolled in these programs is slowly increasing. This increment may be attributed in part to the excellent job market for females in the environmental area, as perceived by contact personnel.

C. Student Origin

Results regarding student origin (i.e., in-state, out-of-state, foreign) reported in Table 3 reveal some interesting though expected differences across degree levels. Students at the associate and bachelors levels are predominantly in-state (99 and 77 percent respectively), while graduate enrollment reflects greater percentages of out-of-state or foreign students.

TABLE 2

NATIONAL ENVIRONMENTAL EDUCATION/ECOLOGY ENROLLMENT PROFILE SUMMARY[1]

Degree	Enrollment Full-time	Enrollment Part-time	Graduates Average # Per Year	Enrollment Change by Program[2] Up	Down	Stable
Associate	81	5	30	0	0	1
Bachelors	2,924	250	728	12	0	10
Masters	402	56	222	3	1	7
Doctoral	41	4	16	1	0	6
TOTAL	3,448	315	996	16	1	24

[1] This profile does not include all institutions offering similar programs in "the country." Caution must therefore be taken in drawing any definitive conclusions regarding this profile.

[2] In some cases, figures represent individual degrees.

TABLE 3

NATIONAL STUDENT-ORIGIN PROFILE

Degree	In-State	Out-of-State	Foreign
Associate	99%	1%	0%
Bachelors	77%	22%	1%
Masters	62%	34%	4%
Doctoral	67%	33%	0%

The reasons for these percentages are not absolute but may reflect several conditions. One, graduate programs--especially those offering excellent research facilities, in-state tuition rates, and assistantships or fellowships--can attract quality, out-of-state students who are competitive with any candidates maintaining residence in home states. Tuition remission and comparable financial aid offers are not widespread at the undergraduate level. Two, associate and baccalaureate degree students may be most attracted to or most familiar with institutions within a reasonable proximity to their homes, especially if full-time employment is a mitigating factor in program choice. Third, some institutions specify the ratio of in-state to out-of-state students.

D. Employment and Environmental Occupations

The job placement of graduates trained in Environmental Education, Ecology, and related areas plays a critical role in meeting environmental workforce needs. Though graduate follow-up characterizes approximately two out of every three programs (or degrees, in some cases), surveys of former students vary in specificity and completeness among institutions. Therefore, data concerning employment of graduates--particularly beyond initial placement--are less than exact. As part of this Phase II survey, contact personnel were asked what percentage of their program graduates are employed in industry, consulting, government, or other fields (teaching positions, etc.). Employment results by degree level are reported in Table 4.

TABLE 4

ENVIRONMENTAL EDUCATION/ECOLOGY COMPOSITE
NATIONAL EMPLOYMENT PROFILE[1]

Degree	Private Sector[2] Industry	Consulting	Total	Government	Other
Associate	30%		30%	60%	10%
Bachelors	33%	6%	39%	47%	13%
Masters	17%	16%	33%	35%	32%
Doctoral	18%	18%	36%	27%	37%
TOTAL	29%	9%	38%	45%	18%

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[1] This profile does not include all institutions offering similar programs in "the country". Caution must therefore be taken in drawing any definitive conclusions regarding this profile.

[2] If contact persons did not distinguish between industry and consulting in their responses, the private sector percentage given was evenly divided between industry and consulting.

Nationally, industry and government appear to draw greater numbers of Environmental Education and Ecology graduates than consulting firms and various educational institutions. Though statistical analyses were not performed, variance across degree levels does not appear significant.

Government, as defined in this survey, encompasses the broad public sector (municipal, state, regional, and federal levels). In large measure, environmental regulation, monitoring, enforcement, and overall protection activities fall under the auspices of this sector. Past legislative mandates to the private sector have precipitated employment opportunities in the public sector to insure implementation. Likewise, the public sector has been forced to employ environmentally trained personnel in order to comply with public sector legislation. Thus, both government and industry need personnel.

The salaries that some educational institutions can afford to pay do not compare favorably with those in government or the private sector, nor are job openings as numerous. Both considerations may help explain the low percentage of graduates entering teaching positions.

In an attempt to identify more specifically those occupations which Environmental Education/Ecology graduates would be qualified to fill, survey participants were asked to check on a prepared form those jobs that graduates of a given degree program would be trained to assume. Occupational titles so identified by a majority of contact personnel responding are listed below according to degree level:

Associate

Biological Technician

Bachelors

Ecologist
Environmental Science Technician

Masters

Chemist

Doctoral

Aerosol Physicist
Aquatic Biologist
Bacteriologist
Chemist
Microbiologist
Pollution Control Specialist

Though the design of this project does not permit ascertainment of longitudinal shifts in employment, such a study would be potentially very useful in projecting necessary modification in training.

E. Graduate Follow-Up

As indicated earlier, approximately 60 percent of the Environmental Education, Ecology, and related programs surveyed engage in some form of graduate follow-up with varying degrees of success. Common methods used are newsletters, questionnaires, personal contact, conventions and professional gatherings, and alumni association records. No responses to this survey item appear unique to a single institution. The important task of tracing graduates, not only to maintain job histories but to obtain curriculum feedback, demands that both program administrators and program graduates share the responsibility.

F. Faculty

Of the 37 Environmental Education/Ecology, and related programs surveyed in Phase II, full-time faculty total 169 (43 percent) and part-time faculty total 227 (58 percent). These figures are based essentially on intra-program definitions of full- or part-time staff assignments. For example, some programs define part-time personnel as faculty who may teach only one course and whose primary responsibilities rest in another department. This factor alone makes any generalization difficult. There do not appear to be any consistent differences across degree levels.

G. Internship/Applied Study Term

Of the 39 separate degree programs offering information, 23 provide for some form of internship or applied study term as part of their student training. These options offer students supervised, on-the-job experience related to their classroom and laboratory instruction. Internship or applied study terms prepare students for real-world situations encountered in subsequent employment and may facilitate job placement. For some students, salaries paid to them for their work under these application-oriented instructional programs are a means of financial aid. Environmentally related internship programs place students in industry, consulting, government, business, and formal and informal educational settings.

II. ADDITIONAL FINDINGS

A. Recruitment Techniques

While some programs claim that their reputation alone attracts quality applicants, most utilize some formal means of recruitment. Posters, brochures, visitations to local high schools, campus career days, and word of mouth number among the most popular and effective methods. Graduate programs often attract students from the same institution's undergraduate student body; and university offices (admission, public relations) supervise and supplement program recruitment efforts on many campuses. Those programs with extensive research facilities, traineeships, or other curricular or financial attractions find such inducements facilitate recruitment. Peterson's Guide entries, which publicize the kernel features of academic programs in many colleges and universities, are occasionally used in recruitment. Former graduates often steer potential students to programs. One institution even televises the "success stories" of its graduates. The success of any one recruitment method is difficult to project across programs and is in reality undoubtedly the function of many intervening variables.

B. Sources of Student Support

Student financial aid packages also help in the recruitment process. For those programs included in this Environmental Education/ Ecology volume, undergraduates typically are supported by scholarships; federal, state, and campus loan programs; college work study; and part-time employment outside the university. The majority of graduate students enrolled in many of these programs are employed by their departments as teaching or research assistants or as support personnel on program grants or contracts. At the graduate level, support funding and/or tuition remission or reduction are often critical variables in enrollment. Traineeships from federal agencies such as the Environmental Protection Agency and the National Institute of Occupational Safety and Health to support students are considered too few in number.

C. Research Funding

The financial stability of environmental programs is often a key to their success or demise. Monies for research enable programs to attract faculty and students. Research funding--most typically in the form of grants, contracts, or consulting work--accounts for minimal to substantial percentages of faculty salaries. Those institutions with more support personnel and services (e.g., graduate students, clerical help, grant writing officers, or research centers) and those able to offer faculty release time for research, not surprisingly tend to be those schools where research funds are more abundant.

Sources of research funding vary widely across programs. More frequently cited ones include:

1) Department of Energy (Energy Research and Development Administration)
2) Department of Health, Education, and Welfare
3) National Institute of Health
4) National Institute of Occupational Safety and Health
5) National Science Foundation
6) U.S. Forest Service

State agencies, private corporations, regional study commissions, and other entities also provide important research funding.

More important perhaps than the question of what agency is giving the most in environmental research funds and student stipends to the educational community is the issue of how critical the continuation and escalation of such financial support is for the maintenance and growth of existing programs. Curriculum changes, additional faculty lines, laboratory costs, and salary increments cost money. Environmental programs are looking more and more to the federal government for financial support. A substantial number indicates that without support, their programs are in danger of decline and even collapse. (For more detailed information regarding sources of research funding and research activities, see individual program summaries.)

D. Usage of ERIC and IRIS

Computerized information retrieval systems now available to the educational community greatly speed initial reviews of literature and provide inexpensive access to a wide variety of materials. ERIC and IRIS are two such retrieval systems that include environmentally-related materials. The inherent effectiveness of ERIC and IRIS depends in part of their utilization within the educational community. Of the Environmental Education/Ecology programs responding to a survey question on usage of these systems, seven out of 16 contact persons indicated that they use ERIC and three out of 15 persons indicate that they use IRIS. Education/Ecology program responses and responses from all institutions participating in this Phase II survey concerning use of ERIC and IRIS are reported in Tables 5 and 6. The results of the composite section parallel those at the national level.

TABLE 5

ERIC/IRIS UTILIZATION PROFILE - EDUCATION/ECOLOGY

	Yes	No	Total Responding
ERIC	7	9	16
IRIS	3	12	15

TABLE 6

ERIC/IRIS UTILIZATION PROFILE - NATIONAL SUMMARY

	Yes	No	Total Responding
ERIC	72	307	379
IRIS	64	314	378

Faculty members responding to this ERIC/IRIS survey item were not asked the reasons for their answers, but a sizable percentage indicated that they were not even aware of these particular information retrieval systems. The fact that IRIS primarily contains water and wastewater materials may help explain the unfamiliarity of environmental education and ecology faculty with this system if their expertise and teaching responsibilities are not in these two areas. However, these results, must prompt questions of how widely disseminated and how widely publicized ERIC and IRIS services are within the environmental training community.

E. Program Flexibility

Changing employment needs and new technology necessitate curriculum modifications in the educational training of our environmental workforce. The time constraints under which schools can implement new courses or new programs (e.g., series of courses, degree offerings) give some indication of the flexibility of the Environmental Education, Ecology, and related programs surveyed in Phase II. Tables 7 and 8 summarize the responses to questions asking the time needed to implement new courses and new programs.

Responses indicate that course changes can usually be implemented within an academic calendar year and program changes can be implemented within one to two years. Differences across degree levels do not appear significant. The fact that program modifications appear to take more time than course implementation is not surprising given the greater scope of a program relative to a single course. Responses to these questions were often conditional; participants indicated that implementation schedules depend in large measure on the availability of faculty time and financial resources, departmental and institutional support, and the preparation readiness of course syallbi and materials. The responses noted in these tables may indeed only represent the minimum time needed to process course and program requests through the institutional structure if there are no intervening complications.

TABLE 7

TIME REQUIRED TO IMPLEMENT A COMPLETE CONTENT CHANGE IN A COURSE

Degree Program	Less than 1 month	1 month-1 year	more than 1 year; less than 2	2-4 years	more than 4 years	Undetermined
Associate	-	2	-	-	-	-
Bachelors	2	17	-	-	-	6
Masters	3	9	-	-	-	3
Doctoral	2	5	-	-	-	-
TOTAL	7	33	-	-	-	9

TABLE 8

TIME REQUIRED TO IMPLEMENT A COMPLETE CONTENT CHANGE IN A PROGRAM

Degree Program	Less than 1 month	1 month-1 year	more than 1 year; less than 2	2-4 years	more than 4 years	Undetermined
Associate	-	-	1	1	-	-
Bachelors	-	10	7	1	-	7
Masters	1	1	8	-	-	2
Doctoral	1	1	5	-	-	-
TOTAL	2	12	21	2	-	9

F. Communication and Financial Management Skills

A concern of professionals in the environmental workforce is that graduates are weak in the communication skills needed to inform the public and private sectors regarding pollution and its control and abatement and the persuasive expertise to stimulate constructive social action based on that information. Survey participants were asked their reactions to this concern. Those contact persons representing Environmental Education, Ecology, and related areas generally agree that adequate communication skills of environmentally trained persons are of major concern. The curricular response designed to sharpen students capabilities in this important area varies from one institution to another and across degree levels. Undergraduate programs typically incorporate courses in communication and writing skills, while graduate students in all areas usually must write an acceptable thesis or dissertation and are encouraged to publish their work. Students at all levels are usually called upon to present oral reports in classes and seminars. A common consensus among environmental educators is that post-secondary students in all disciplines--not just Environmental Education and Ecology--lack adequate communication-skills preparation. The solution of this problem rests with the entire educational community and is not easily achieved.

Similar concerns regarding financial management skills of environmental graduates elicited slightly different responses. Courses in economics, business management, and accounting are often included in Education/Ecology program requirements. Survey participants generally agree that environmental policy and decision-making must reflect sound short- and long-term economic projections; and they make every attempt to train their students in this area.

III

A Summary Profile of Representative Educational Programs

The following footnotes (1-6) refer to the various column headings of the Table. Other footnotes are specific to the figures which were provided by various institutions and are used throughout the Table.

[1] Enrollment - 1976-77 statistics

[2] Graduates - average for last three years; 'change' indicated apparent trends within that three-year period

[3] Employment - 'other' includes positions such as those found within the educational community

[4] Faculty - full-time and part-time is determined by individual institutions

[5] Internship/Applied Study - part of an option to obtain a degree; may or may not have financial reimbursement connected with it

[6] Graduate Follow-up - a standardized procedure that enables the institution to periodically determine the employment of their graduates

[7] enrollment figures are estimated

[8] Juniors and Seniors only

[9] forty other faculty teach in interdisciplinary courses

[10] four participating departments each appoint a coordinator

NA - Not Available/Not Applicable

*Asterisk - denotes that a program appears in more than one volume of the profile

TABLE

A SUMMARY PROFILE OF REPRESENTATIVE

STATE	INSTITUTION	PROGRAM	DEGREE	ENROLLMENT[1]		GRADUATES[2]	
				FULL TIME	PART TIME	No. / YEAR	CHANGE
CA	University of California-Santa Barbara	Environmental Studies	B.A.	445	5	120	Stable
FL	Florida International University	Environmental Studies	B.S. B.A.	12[7]	24[7]	12	Up
	University of Florida	Systems Ecology Environmental Resources Management	M.E.	103	0	4	Down
			M.S.			22	Stable
			Engr.	0	0	0	Stable
			Ph.D.	0	0	0	Stable
IL	Sangamon State University	Environments and People	B.A.	18	11	8	Up
			M.A.	8	31	8	Up
IN	Indiana University	Environmental Programs	B.A.	46	0	31	Stable
			B.S.P.A.	49			
			M.S.E.S.	52	0	11	Up
			M.P.A.	25	3	8	Up
			Ph.D. (Minor)	2	0	0	Stable
IA	Iowa State University	Environmental Studies	Major/ Minor	0	60	6	Up
KS	University of Kansas	Environmental Studies	B.A.	55[8]	0	25	Stable

EDUCATION/ECOLOGY PROGRAMS

STUDENT ORIGIN IN-STATE/ OUT-OF-STATE/ FOREIGN (%)	EMPLOYMENT				FACULTY[4]		INTERNSHIP/[5] APPLIED STUDY		GRADUATE[6] FOLLOW-UP	
	PRIVATE SECTOR INDUSTRY	PRIVATE SECTOR CONSULTING	GOV'T	OTHER[3]	FULL TIME	PART TIME	YES	NO	YES	NO
90/10/NA	25%		50%	25%	7	20	X			X
95/5/NA	50%		50%		0	12		X		X
40/60/NA	11% 23%	19% 24%	40% 29%	19% 24%	17	0		X	X	
95/5/0	5%		80%	15%	5	5	X		X	
54/39/7		46%	27%	27%	7	4	X		X	
							X		X	
32/61/7		60%	32%	8%			X		X	
67/27/6	N/A	N/A	N/A	N/A	2	N/A		X		X
80/20/0	N/A	N/A	N/A	N/A	1	0	X			X

TABLE

A SUMMARY PROFILE OF REPRESENTATIVE

				ENROLLMENT[1]		GRADUATES[2]	
STATE	INSTITUTION	PROGRAM	DEGREE	FULL TIME	PART TIME	No. / YEAR	CHANGE
KY	Morehead State University	Environmental Studies	B.A./ B.S.	80	22	15	Up
MI	Michigan State University	Natural Resources and Environmental Education	B.S.	155	35	50	Up
		Environmental Conservation Education	M.S.	20	0	5	Up
			Ph.D.	6-10	0	2	Up
		Ecological Systems	M.S.	4	0	3-4	Stable
			Ph.D.	9			
	University of Michigan	Environmental Education	B.S.	70	0	25	Stable
			M.S.	25-30	3-5	15-20	
			Ph.D.	7-9	1-2	2	
MN	Bemidji State University	Environmental Studies	B.S.	104	10	N/A	N/A
			M.A.	9	21		
	Macalester College	Environmental Studies	B.A./ B.S.	40	0	10	Stable
NJ	Princeton University	*Environmental Science/Policy	B.S.	0	44	13	Up

EDUCATION/ECOLOGY PROGRAMS

STUDENT ORIGIN IN-STATE/ OUT-OF-STATE/ FOREIGN (%)	EMPLOYMENT PRIVATE SECTOR INDUSTRY	EMPLOYMENT PRIVATE SECTOR CONSULTING	EMPLOYMENT GOV'T	EMPLOYMENT OTHER[3]	FACULTY[4] FULL TIME	FACULTY[4] PART TIME	INTERNSHIP/[5] APPLIED STUDY YES	INTERNSHIP/[5] APPLIED STUDY NO	GRADUATE[6] FOLLOW-UP YES	GRADUATE[6] FOLLOW-UP NO
85/15/NA	28%	13%	40%	7%	1	21		X	X	
90/10/0	2%	3%	10%	85%	None[10]	0	X		X	
90/10/0	2%	1%	10%	87%	4	0		X	X	
90/10/0	2%	1%	10%	87%	4	0		X	X	
NA/NA/40	N/A	N/A	N/A	N/A	14	0	X		X	
60/40/NA	30%		27%	43%	4	0	X		X	
80/20/0	25%		75%		1	6	X		X	
50/50/0		N/A			6	0	X			X
30/60/10	50%		50%		0	21		X		x

A SUMMARY PROFILE OF REPRESENTATIVE

STATE	INSTITUTION	PROGRAM	DEGREE	ENROLLMENT[1] FULL TIME	PART TIME	GRADUATES [2] No. / YEAR	CHANGE
	Rutgers-State University of New Jersey	Environmental and Business Economics	B.S.	190	2	45	Up
		Environmental Studies	B.S.	198	2	60	Up
		International Environmental Studies	B.A. B.S.	30	0	0	Up
NC	Duke University	Environmental Management	M.E.M.	41	0	35	Stable
OH	Antioch College	Environmental Studies	B.A./ B.S.	80	3	34	Stable
	Miami University	Environmental Sciences	M.En.	49	0	12	Up
	Muskingum Area Technical College	Natural Resources Conservation Technology	A.A.S.	81	5	30	Stable
	Ohio State University	Environmental Education	B.S.	122	13	40	Stable
			M.S.	19	19	10	Stable
			Ph.D.	0	2	1	Stable
PA	The Pennsylvania State University	*Environmental Resource Management	B.S.	583	0	110	Up
	University of Pittsburgh	Environmental Systems Engineering	M.S.	12	0	4	Stable

EDUCATION/ECOLOGY PROGRAMS

STUDENT ORIGIN IN-STATE/ OUT-OF-STATE/ FOREIGN (%)	EMPLOYMENT				FACULTY[4]		INTERNSHIP/[5] APPLIED STUDY		GRADUATE[6] FOLLOW-UP	
	PRIVATE SECTOR INDUSTRY	PRIVATE SECTOR CONSULTING	GOV'T	OTHER[3]	FULL TIME	PART TIME	YES	NO	YES	NO
80/20/0	60%		40%		5	11		X	X	
95/5/0	20%		80%		0	16	X		X	
90/10/0	N/A	N/A	N/A	N/A	0	10		X	X	
5/95/NA	10%	10%	80%		16	6	X		X	
10/90/0	25%		75%		10	0	X		X	
65/25/10	7%	12%	43%	38%	1	6-10	X		X	
99/1/0	30%		60%	10%	3	0	X		X	
69/29/2 69/23/8 50/50/0	50%		50%		5	0	X		X	
95/5/0	50%		50%		1	10	X		X	
20/80/0	5%	10%	60%	25%	0	7		X		X

TABLE

A SUMMARY PROFILE OF REPRESENTATIVE

STATE	INSTITUTION	PROGRAM	DEGREE	ENROLLMENT[1]		GRADUATES[2]	
				FULL TIME	PART TIME	No. / YEAR	CHANGE
TX	Baylor University	Environmental Studies	B.A.	50	0	8	Stable
UT	Utah State University	Environmental Studies	B.S.	70	0	20	Up
WA	Evergreen State College	Environmental Studies	B.A.	170	0	30	Stable
	University of Washington	Environmental Studies	B.S.	16	1	11	Stable
	Washington State University	Environmental Science	B.S.	35	0	20	Stable
			M.S.	52	0	20	Stable
	Western Washington University (Huxley College)	Environmental Studies	B.S.	250	0	65	Up
WI	Northland College	Environmental Studies	B.A.	178	0	N/A	N/A
	University of Wisconsin-Green Bay	Environmental Emphasis	B.S. B.A.	N/A	N/A	N/A	N/A
		Global Ecology/ Environmental Administration	M.E.A.S.	60	20	N/A	N/A

9

EDUCATION/ECOLOGY PROGRAMS

STUDENT ORIGIN IN-STATE/ OUT-OF-STATE/ FOREIGN (%)	EMPLOYMENT				FACULTY[4]		INTERNSHIP/[5] APPLIED STUDY		GRADUATE[6] FOLLOW-UP	
	PRIVATE SECTOR INDUSTRY	PRIVATE SECTOR CONSULTING	GOV'T	OTHER[3]	FULL TIME	PART TIME	YES	NO	YES	NO
60/40/NA	30%		50%	20%	1	15		X	X	
15/85/NA	28%	29%	43%		0	50		X		X
80/20/NA	30%		70%		17	0	X		X	
70/30/NA	40%	30%	30%		3	2	X		X	
90/10/NA	60%		40%		4	3		X	X	
90/10/NA	50%	25%	10%	15%				X	X	
30/70/NA	60%		40%		15	0	X		X	
64/36/0	27%		50%	23%	15	0	X			X
88/12/0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	X		X

TABLE

A SUMMARY PROFILE OF REPRESENTATIVE

				ENROLLMENT[1]		GRADUATES[2]	
STATE	INSTITUTION	PROGRAM	DEGREE	FULL TIME	PART TIME	No. / YEAR	CHANGE
WI	University of Wisconsin-Green Bay	Environmental Management	M.E.A.S.	N/A	N/A	N/A	N/A
		Waste Management and Resource Recovery					
	University of Wisconsin-Madison	Environmental Communications	M.A./ M.S.	10	0	7	Stable

9

EDUCATION/ECOLOGY PROGRAMS

STUDENT ORIGIN IN-STATE/ OUT-OF-STATE/ FOREIGN (%)	EMPLOYMENT				FACULTY[4]		INTERNSHIP/[5] APPLIED STUDY		GRADUATE[6] FOLLOW-UP	
	PRIVATE SECTOR INDUSTRY	PRIVATE SECTOR CONSULTING	GOV'T	OTHER[3]	FULL TIME	PART TIME	YES	NO	YES	NO
88/12/0	N/A	N/A	N/A	N/A	N/A	N/A		X	X	
50/50/0	N/A	N/A	N/A	N/A	N/A	N/A		X		X

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University Catalog 1975-76

PROJECT COMMENTARY

Photo reprinted from the
University of Missouri,
Columbia Bulletin 1977

PROJECT CONSTRAINTS

In preparation for the on-site interviews, all of the institutions' catalogs were intensively reviewed in order to determine where environmental programs were being offered. During the course of this study, 171 institutions were visited and a total of 338 environmental programs, representing 45 states and Washington, D.C., were surveyed in detail. Albeit significant, these programs represent only a portion of all such programs available and cannot be construed as an in-depth survey of all environmental programs. It is, however, a representative sample within each of the environmental pollution control areas of Air, Noise, Pesticides, Radiation, Water and Wastewater, Solid Waste and Energy.

Several constraining factors to the proposed comprehensiveness of the study were encountered while collecting data from the institutions. It was disappointing to find that definitive records or statistics were generally unavailable which would describe specifically the placement of environmental program graduates. General indications of placement within categories, such as government or industry, were often available in percentages only. Depending on the size of the program and its age, some contact people could describe all graduates, others knew only where the past year's graduates were presently employed, and still others were aware only of their advisees entry-level positions and subsequent moves.

It also became clear during the on-site interviews that some programs of similar or identical content had different titles. This lack of clarity within the environmental areas serves to confuse the casual reader. For that reason, attention must be directed to the actual environmental course listings included in each program summary.

A list of terms commonly used during the on-site interviews and subsequently in this report was developed in order to facilitate precise data gathering. The reader is directed to Appendix II, TERMINOLOGY.

No attempt was made, in this report, to qualitatively judge any of these programs. The apparent absence of substantial qualitative measures in the environmental education field in general and the desire to collect data in a neutral atmosphere underscore the reasons for this omission. It appears that there is a need for the development of an environmental program model in each of these areas in order that some qualitative standards be provided where none now exist.

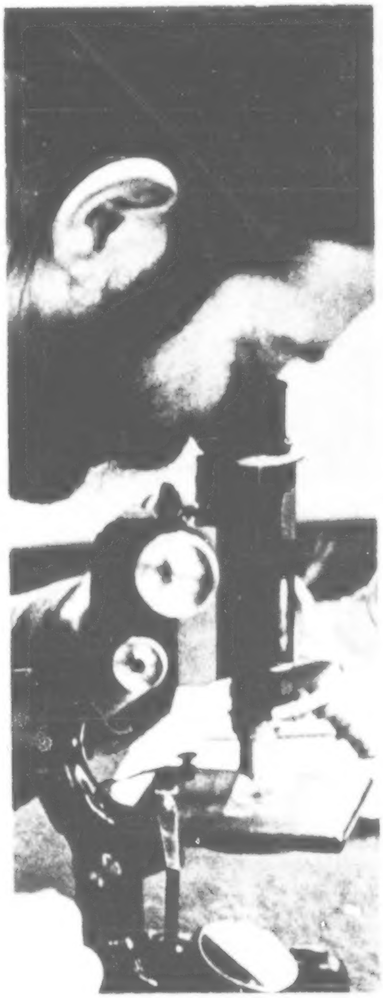
PROJECT COMMENTARY

The preceding analyses of data gathered from Environmental Education/Ecology programs indicate those trends and future projections than can be made given quantitative information from project participants. To synthesize and summarize, enrollments and workforce production in these composite programs are generally stable or increasing. Employment profiles indicate that a larger percentage of graduates enter industry and government service rather than consulting or teaching. Program personnel, for the most part, were able to categorize entry-level positions. Subsequent occupational transfers were not identifiable unless extensive graduate follow-up procedures were utilized. Several generalizations regarding employment trends may be ascertained by examination of the individual program summaries.

The objectives and curricular structure of the Education/Ecology programs surveyed in Phase II reflect a broadly-conceived philosophical commitment to environmental training. Solutions to problems of pollution control and abatement are no longer the sole responsibility of the engineer or wastewater treatment plant operator. They demand the efforts and expertise of social and behavioral scientists, economists, media personnel, and educators. As evidence of this holistic approach, a number of Education/Ecology programs include or propose to include training in the drafting of environmental impact statements now mandated by the federal government.

A matter of some concern for faculty and administrators of Education/Ecology programs is the future job market for their graduates. Employment opportunities are often dependent upon shifting economic and social priorities, and predictions are difficult. Communication between post-secondary environmental programs and the private sector and governmental agencies that employ graduates of those programs is critical if environmental workforce needs are to be adequately met.

LIST OF COMPOSITE TRAINING INSTITUTIONS BY DEGREE



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Northland College Catalog
1975-76

LIST OF COMPOSITE EDUCATION/ECOLOGY TRAINING INSTITUTIONS BY DEGREE

ASSOCIATE

Muskingum Area Technical College

BACHELORS

Antioch College
Baylor University
Evergreen State College
Florida International University
Iowa State University
Macalester College
Morehead State College
Northland College
*Princeton University
Rutgers - State University of New Jersey
*The Pennsylvania State University
University of California - Santa Barbara
University of Kansas
University of Washington
Utah State University
Western Washington University (Huxley College)

MASTERS

Duke University
Miami University
University of Wisconsin - Madison

MULTIPLE DEGREES OFFERED BY ONE INSTITUTION

Certificate/Associate/Bachelors/Masters/Doctoral

Indiana University

Bachelors/Masters

Bemidji State University
Sangamon State University
University of Wisconsin - Green Bay
Washington State University

Bachelors/Masters/Doctoral

Michigan State University
Ohio State University
University of Michigan

Masters/Doctoral/Engineer

University of Florida

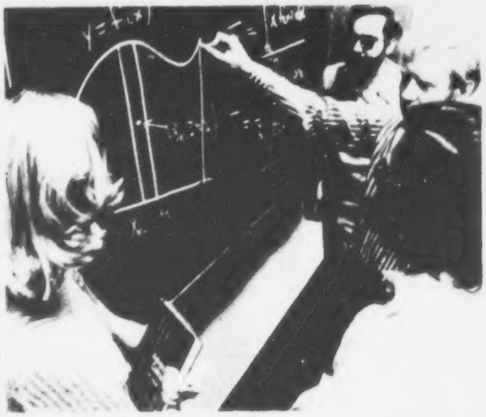
NON-DEGREE

University of Pittsburgh

*Denotes that the program appears in another volume(s)

OTHER PROGRAMS

- Kansas State University
- Miami-Dade Community College
- University of Florida
- University of Miami



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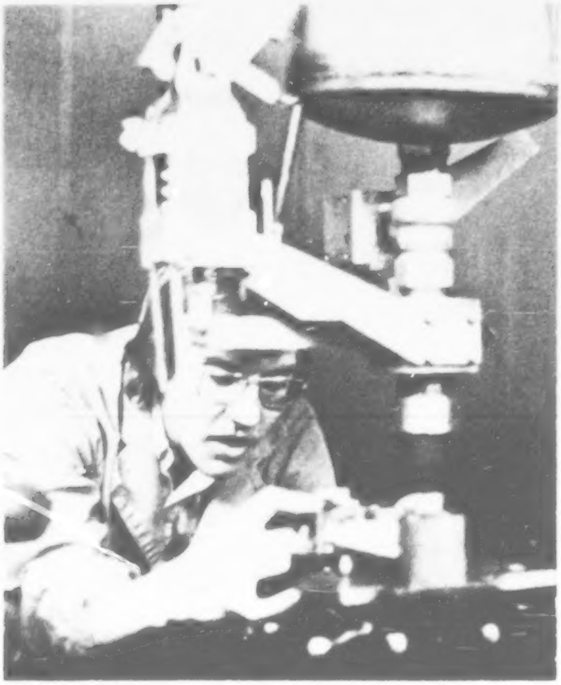
COMPOSITE
TRAINING SUMMARIES



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Engineering Experiment Station, College of Engineering,
University of Wisconsin, Madison

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INSTITUTION: ANTIOCH COLLEGE (YELLOW SPRINGS CAMPUS)

PROGRAM: Environmental Studies

DEPARTMENT:

DEGREE: Bachelor of Arts (B.A.)
Bachelor of Sciences (B.S.)

CONTACT: Mr. Rodney Bean
Science Institute
Antioch College
Yellow Springs, Ohio 45387
(513) 767-7331

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The Environmental Studies Center, established in 1966, prepares students as generalists with wide-ranging interests and as specialists with pragmatically designed training and skills. The experiential education program--an alternating sequence of work and on-campus study--is a critical part of the Antioch degree for it enables students to judge more effectively how they can best shape their education to meet their short- and long-term needs. Experiences (e.g., jobs, education abroad, specialized courses or projects not for academic credit, travel) are meant to immerse students in the "community and living environment" of their selected off-campus opportunity.

Over 800 "field faculty" in forty-eight states and representing business, industry, professions, government, and non-profit organizations provide jobs, supervision, and most of all, training to Antioch students. Co-op employers of students have included the U.S. Forest Service, Jackson Laboratories, National Park Service, Scripps Institute of Oceanography, Natural Resource Ecology Laboratory, and Environmental Protection Agency.

Facilities at the Antioch campus in Yellow Springs include Glen Helen, a 1000-acre nature preserve, which serves as a community environmental education center and an excellent, convenient laboratory. Students manage the Glen's information center and conduct its programs. An outdoor education center located nearby provides residential-learning workshops for area school teachers and their students. Antioch has recently been designated by the National Park Service as a National Environmental Study Area for its exemplary program in environmental education.

Field Programs allow students to study environments away from Yellow Springs. Programs have been centered in the Sonoran Desert, California Sierra, southeastern U.S. seaboard, and various Caribbean Islands. Through these extended laboratories, "resources customarily used to maintain fixed biological or geological research field stations are here invested in vehicles and equipment devoted completely to this program and used in seeking out a variety of people in local areas who have direct knowledge about their surroundings."

Faculty have received several small grants for solar research from the National Science Foundation and have submitted a CAUSE ("Comprehensive Assistance to Undergraduate Science Education") grant proposal requesting funds for basic laboratory equipment and other curriculum materials to update their courses to meet contemporary training needs. The emphasis at Antioch is on teaching, not research, though several college faculty members do publish actively.

PROGRAM REQUIREMENTS

For the B.A. degree, a student must complete 160 academic credits: 64 of general education, 60 in a field of concentration, and 36 elective or exploration credits. For the B.S. degree, the student's required 160 academic credits are distributed as follows: 44 general education credits other than science, 45 basic science credits, 40 credits in a field of concentration, and 31 elective or exploration credits. Students must complete 8 quarters of experiential (co-operative) education, 2 of which may be waived if the student is graduating in four years. There are no established required courses in the Environmental Studies Program; each student follows a unique plan of study. Core courses should insure that the student has the basic writing, mathematical, and other skills necessary to do college work; and their structure and sequence are the responsibility of the student and advisor. A field of concentration revolves around the student's "interests, aptitudes, and life aims" and consists of courses, perhaps from several departments, work experiences, and community participation. "As far as possible, students use the off-campus program to learn the particular skills, facts, methods, and application needed for immediate post-college jobs."

Admission to Antioch normally requires a high school diploma or its equivalent, but the school typically "seeks students from diverse parts of society, religions, socio-economic, geographical, and ideological, particularly under-represented subgroups." Antioch "still review[s] traditional measures of academic potential, but give[s] extra weight to maturity, tenacity, self-reliance, and past involvement and success in their schools and communities." Students are screened into the Environmental Studies Program.

CURRENT FACULTY, STUDENTS, GRADUATES

Ten full-time faculty teach Environmental Studies courses. (Six of these faculty are in the Science Institute.) Students do not declare a major until the end of their second year; but given that parameter, there are approximately eighty full-time and three part-time Environmental Studies majors. The College graduates an average of thirty-four students in this program annually though additional degrees conferred in related disciplines may in actuality represent Environmental Studies majors.

Graduates are placed in the private sector (25%) and in government jobs (75%). With the cooperative, experiential program, however, "students in one sense begin their ultimate job placement with enrollment rather than with graduation."

One-third of the Antioch student body and thirty to forty percent of the Environmental Studies students receive some form of financial support, especially to pay for the Field Program expenses. Sources of aid include National Direct Student Loans, college work-study, Supplementary Educational Opportunity Grants, Antioch tuition grants, Basic Educational Opportunity Grants, guaranteed student loans, and home state grants. Any salaries earned as part of the cooperative work experience are the student's to manage as he/she sees fit.

PROGRAM PROJECTIONS

Faculty and staff at Antioch are working toward the establishment of a M.S. degree in environmental studies (applied technology, monitoring) on the Yellow Springs campus. To do this, modifications must be made to the physical plant, especially for training in monitoring technology. Antioch experienced a drastic enrollment drop in 1972, but an annual 5-6% increase in students has been seen since that time. With funding for CAUSE (grant proposal to update undergraduate science courses), the program will receive additional curriculum materials and be able to finance needed laboratory renovations. Faculty see an increase in the number of jobs available to Environmental Studies graduates; and with the blend of general and specialized training provided Antioch students, the employment picture is bright. As one professor notes, "If 'environment' is a fad, it will be the last one."

COURSE DESCRIPTION (a partial listing of courses)

Environmental Studies: EnvS 132 Towns and Cities - A geographical look at the form, function, and meaning of urban places, focusing on the character of towns and cities as changing human environments. The small town today, the physical and social environment of the city, a comparison of free market/socialist urban structure and design, etc. Field work, reports, projects involving southwestern Ohio towns and cities. (3 q.h.)

156 Introduction to Soil and Plant Nutrients - Soil formation, classification, distribution, nutrients, nutrient depletion, and conservation. Seminars on plants' use of soil. Field trips. (5 q.h.)

166 Practicum in Environmental Education - Students lead children (ages 6-11) in exploration of sensory awareness, natural history and folklore of Glen Helen Participation in lesson planning, some assigned reading, keeping journal. Develops teaching techniques applicable to classrooms, school yards, natural areas. (3 q.h.)

206 Engineering of Energy - Some established principles and practices of thermodynamics and how they can improve the environment. Established energy conversion processes, such as internal combustion engines, fossil-fuel power plants, refrigeration, etc., examined qualitatively and quantitatively. Transforming energy for social purposes in ways least detrimental to living environments. (5 q.h.)

208 Biological Control - Human efforts to use organisms to regulate environmental problems: pathogens, pests, invasive plants, erosion, harmful vertebrates, and others. Current theory and practice using research and control programs as models. (5 q.h.)

226 Mineral and Water Resources - The energy crisis in perspective. Environmental aspects of mining. Origin and world distribution of minerals; their effect on world history, governments, and tomorrow's standard of living. Water occurrence and pollution. (5 q.h.)

243 Practical Analysis of Causes and Effects and Possible Solutions of Environmental Destruction - The historical causes and present socio-economic basis for environmental destruction. Past and present movements opposed to the waste of natural resources or the destruction of nature and their potentials and limitations. (5 q.h.)

244 Environmental Botany - Introduction to plant science, with emphasis on ecology. Field work. (5 q.h.)

245 Environmental Visualization and Representation - Ways of organizing, evaluating, and representing geographic environments. Basic work in compiling and representing environmental data, making and using maps, and elementary geographic description. Use of census information. (5 q.h.)

255 Planning and Environment - Means and ends of constructively shaping future environments. Critical assessment of present planning that affects Antioch and the Greater Miami Valley, with stress on methods of developing skills, using research materials, and involving students in planning. (4 q.h.)

272 Geology of Environmental Problems - Geological influences on land use. Effort of waste disposal on water resources; effect of geology on regional land-use patterns; mineral resource use by an industrial society; effect of geomorphic processes on land use. Useful for land planning (3 q.h.)

276 Environmental Perception - Ways in which man views, conceptualizes, and responds to his environment. Some of the motives behind why man often changes it, and sometimes abuses it, to fit his needs, ideologies, and values. (5 q.h.)

286 Environmental Interpretation - Survey of current interpretive work methodology; development of skills in interpretation of biologic, geologic, ecologic, and historic aspects of natural and man-made environments. Lab work includes work with elementary school students in Glen Helen. (5 q.h.)

302 Environmental Studies Seminar - Faculty members from different disciplines discuss problems of environmental policy. Focus varies from year to year, but the scope is broad, involving economic, political, biological, and physical factors. Debate of competing notions about solutions to environmental problems. (5 q.h.)

308 The Aquatic Environment - Biological and physical aspects of aquatic communities. Theory and experimental methods. Lab explores local waters. (5 q.h.)

In addition: Two environmental field programs are schedules each year in different areas. These programs, which span one study quarter each, have taken place in the Southwestern desert, Appalachia, the Florida Everglades, the Caribbean, the Colorado plateau, and the arctic tundra of Alaska. Field studies that are offered include Botany, Ecology, Geography, Biology, Geology. Because each course is designed for a particular program, no descriptions are given. In order to take these courses, students must be accepted to a field program. About twenty students per year participate. Students may earn up to twenty credits in these field programs, and may earn credit for planning such studies. Each program carries five credits.

INSTITUTION: BAYLOR UNIVERSITY

PROGRAM: Environmental Studies

DEPARTMENT: Institute of Environmental Studies

DEGREE: Bachelor of Arts (B.A.) or Bachelor of Science (B.S.)
in Environmental Studies

CONTACT: Dr. W. Merles Alexander
Director, Institute of Environmental Studies
Baylor University
Waco, Texas 76703
(817) 755-1611

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

Approval for the Institute of Environmental Studies at Baylor University, was granted in 1969, and in 1970 the first classes were conducted. The Institute offers a curriculum of study which leads to the baccalaureate degree. The program is interdisciplinary and is designed around environmental problem identification and the pursuit of appropriate solutions through environmental research.

Graduates of this program are equipped with a broad-based background. The holistic approach to training these students allows for identification and analyses of environmental problems as well as subsequent program design for alleviation of these problems. Graduates are equipped, as generalists, to provide expertise on a wide variety of environmental problems and solutions to both the public and the private sectors.

PROGRAM REQUIREMENTS

The baccaluareate program of environmental studies is individually designed in order to maximize the student's environmental education. Generally, however, the student must complete 28 semester hours of course work which includes: ES 1301, 1101, 2375, 3300, 3303, 4302; and, two courses from the student's major department.

In addition, the student must successfully complete the general education requirements of the university and the departmental requirements for a major. In total, a minimum of 124 semester hours must be completed in order for the student to be eligible for either the Bachelor of Science or the Bachelor of Arts degree.

Students are assigned an environmental studies advisor to assist in developing the student degree plan. There are a number of departments which participate in this program. Among them are the following: chemistry; biology; economics; geology; journalism; physics; psychology; political science; religion; and, sociology.

CURRENT FACULTY, STUDENTS, GRADUATES

At present the faculty is composed of one full-time, and 16 part-time personnel, for a full-time-equivalent of six. Currently, there are no part-time students. The full-time students total 50, of which 30 are male and 20 are female. The program attracts a large number of students who are transfers from other departments. Historically, however, the program does not attract the adult career change student.

Over the last three years graduates have ranged from six to ten per year. Approximately 30% to 40% of these graduates choose continued schooling, rather than entering the world of work upon graduation. Those seeking employment upon completion of the degree, accept jobs in the public sector usually to a greater degree than the private sector.

PROGRAM PROJECTIONS

The faculty and staff associated with the Institute of Environmental Studies, would like to expand the program somewhat, while at the same time retaining the applied and general emphasis. Student enrollment is anticipated to increase. Two members will be added to the faculty within the next two years.

In addition, the University and the Institute are currently investigating the possibility of establishing new degree programs. The proposed programs would emphasize air pollution and the solar energy fields.

COURSE DESCRIPTION (selected)

1101 (101L) An Introduction to Environmental Analysis - Methods of collection, analysis, and interpretation of environmental data as used in the social, behavioral, physical, and biological disciplines. (1 s.h.)

2375 (175) The Environment and Pollution - Structure and functions of ecosystems. Energy inputs, transformation and transfer processes. (3 s.h.)

3300 (204) The Environment and Political Processes - The causes, the magnitude and the meaning of the "Ecological Crisis," and analyses of the way in which environmental problems translate into political issues. (3 s.h.)

4323 (385) The Environment and Economic Analysis - Economic analysis in description, analysis, and policy formulation of environmental problems such as natural resource development, ecology, energy needs, noise, water, and air pollution. (3 s.h.)

4325 Mathematical Techniques in Environmental Studies - Development and application of empirical models of turbulence and diffusion for single and multiple source urban air pollution plumes. (3 s.h.)

4365 (365) The Environment and Energy - Study of the fundamental concepts of energy dealing with the nature of energy flows-solar, geothermal, stored chemical, etc., and considerations of the relationship of potential energy, energy loss, and reversible and irreversible processes. (3 s.h.)

4393 (393) Environmental Ethics - A study of the moral perspectives which inform and support environmental activity in our society. (3 s.h.)

INSTITUTION: BEMIDJI STATE UNIVERSITY

PROGRAM: Environmental Studies

DEPARTMENT: Division of Science and Mathematics
Center for Environmental Studies

DEGREE: Bachelor of Science (B.S.)
Master of Arts (M.A.)

CONTACT: Charles H. Fuchsman, Director
Center for Environmental Studies
Bemidji State University
Bemidji, Minnesota 56601
(218) 755-2920

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The Center for Environmental Studies, founded in 1968, is a research and teaching unit of Bemidji State University. Its activities are directed to understanding our environment and to preventing its deterioration.

The Center offers formal programs of instruction culminating in B.S and M.A. degrees in Environmental Studies. The B.S. degree is granted on completion of a four-year multi-disciplinary program with concentration in environmentally related courses in the natural and social sciences. The M.A. degree is granted on completion of a graduate program intended to integrate the scientific and social concepts inherent in environmental problems. Separate courses of study within this program are specifically adapted to the needs of teachers, nature study guides, government officials, research scientists, and lay citizens.

The Center conducts laboratory and field research on environmental problems. The Center's research work has been largely financed by Federal and State governmental agencies, and by private companies. Some exploratory research is, however, supported by college funds.

Members of the Center offer professional guidance on environmental problems to government organizations.

The academic programs of the Center for Environmental Studies are reviewed by an advisory committee consisting of representatives of leading industries, engineering firms, and government regulatory agencies in Minnesota and adjacent states. This committee provides guidance in the evaluation of the soundness of the courses of study, and of their relevance to employment needs.

PROGRAM REQUIREMENTS

All students entering Bemidji State University are eligible for admission to the B.S. program.

Applicants seeking admission to the M.S. program in Environmental Studies should have completed at least one undergraduate course in each of the following: biology, chemistry, physics, economics, and political science. (Applicants who do not meet this requirement may be granted conditional admission.)

The Graduate Program in Environmental Studies is intended for four different categories of graduate students, identified as Tracks I, II, III and IV.

Track I	For informed and concerned citizens, who have no professional goals in the environmental field, but who wish to understand current problems and controversies and to help improve the environmental quality of life in their communities and throughout the world.
Track II	For teachers and school administrators who wish to include environmental instruction within their area of competence.
Track III	For technically trained persons interested in advancing their professional careers in the fields of environmental preservation and pollution abatement.
Track IV	For program leaders in parks, museums, nature centers, and camps, and for those who plan to teach about the environment in less conventional learning centers.

CURRENT FACULTY, STUDENTS, GRADUATES

One faculty member devotes full time to Environmental Studies. Other members of the Center for Environmental Studies (a total of 25) participate in externally funded research projects. Six are closely identified with courses given in their respective departments and required for the B.S. degree in Environmental Studies.

An accurate count of students is not available due to persons temporarily off campus and a large number of "summer only" students at the M.A. level. Approximately 104-114 are enrolled in the B.S. program; 9-30 in the M.A. program.

An Associate in Science degree program graduated two persons before being dropped. Since 1974, about 25 persons have received the B.S. degree and 9 the M.A.

Among the B.S. graduates, about 50 percent are employed in a field related to their specialty or go into graduate studies. The others find employment unrelated to their major study, or are unemployed. Of those employed, 75 percent are in the public sector; 25 percent in the private sector.

Among M.A. graduates, almost all are employed, 75 percent in government; 25 percent in the private sector. Employment is in environmentally related areas or teaching.

COURSE DESCRIPTION

(the following is a partial listing of courses)

Geography: 301 Applied Climatology - Geographical investigations of man's perception and utilization of the climatic aspects of the environment. The costs and benefits of weather knowledge. Climatic involvement in economic activities; sociological and physical aspects; politics and planning. (4 q.h.)

309 Conservation of Natural Resources - Factors of resource exploitation. Methods of wise use of soils, forests, waters, minerals, wildlife and recreational areas. (4 q.h.)

331 Land Use Analysis and Planning - An examination of the identification and inventory methods of land use analysis including the designing of land use models which are compatible with environment, social and economic goals. (4 q.h.)

333 Environmental Perception - Spatial analysis of the variations of decision making processes resulting from man's perception of environment. A systematic survey of pertinent concepts of hazard perception, resource perception, landscape perception, and perception research as related to the concerns of regional and urban planners. (4 q.h.)

Political Science: 210 Politics of Pollution - This course is designed to examine the political interaction involved in policy decisions affecting the environment. Alternative solutions for environmental problems will be studied in terms of their political viability. (3 q.h.)

Industrial Arts and Technology: 260 Impact of Technology on Man and Society - A survey of technological trends, production techniques, manpower needs, and a study of the social implications of automation and cybernetics on modern society. Geared for general interest. (3 q.h.)

370 World of Energy - An examination and study of the transcomplete energy cycle through various power applications. Applicable to junior high school laboratories. (2 q.h.)

Biology: 111,112,113 The Environment and Man: Basic Biology - A general introduction to modern biology, with emphasis on basic concepts of form, function, evolution, and environmental interrelationships. (4 q.h.)

242 Vertebrate Physiology - Functions of the organ systems of vertebrates, with emphasis on mammals. (5 q.h.)

261 General Ecology - Interrelationships of organisms and their environments, major communities. Highly recommended for the elementary major. (4 q.h.)

331 Entomology - The biology of insects, their natural history, morphology, classification, and economic importance. (5 q.h.)

362 Environmental Conservation - Methods of wise use of soils, forests, waters, minerals, wildlife, and recreational areas. (4 q.h.)

363 Soils - Introduction to the principles of soil genesis, the physical, chemical, and biological properties of soils. (5 q.h.)

366 Limnology - Introduction to the biology, chemistry, geology, and physics of lakes and streams. (5 q.h.)

371 Microbiology - Structure, classification, and physiology of bacteria and related micro-organisms. (5 q.h.)

374 Productivity of Aquatic Environments - The problems related to establishing and quantitatively measuring the flow of matter and energy through aquatic ecosystems are discussed. (4 q.h.)

383 Phycology - Morphology, physiology, ecology, and taxonomy of algae with emphasis of fresh-water algae of Minnesota. (4 q.h.)

384 Aquatic Vascular Plants - Structure, physiology, reproduction, taxonomy, and ecology of aquatic vascular plants. (4 q.h.)

386 Biology of Polluted Waters - This course provides a detailed discussion of the effects of additional pollutants upon aquatic life in natural waters. Suggestions of possible solutions to water pollution problems are made. (4 q.h.)

421 Parasitology - The biology of animal parasites, their structure, classification, and life histories. (5 q.h.)

452 Mammalogy - Ecology, distribution, classification, adaptations and evolution of mammals. Morphology and identification of local forms. (5 q.h.)

464 Radiation Biology - Absorption of radiations in living systems, utilization of radioisotopes and radiations as tools in biological research and medicine (4 q.h.)

468 Pollution Ecology - Discussion of the cultural basis of environmental pollution, types of pollutants and their ecological effects, and methods of pollution control. (4 q.h.)

Chemistry: 111, 112, 113 General Chemistry I, II, III - Survey of chemistry covering basic concepts from physical, inorganic, and organic chemistry. Primarily for general education and for biology and geology majors. (3 q.h.)

121, 122, 123 Principles of Chemistry I, II, III - Principles of inorganic, physical and solution chemistry. Primarily for chemistry majors and minors, pre-engineers, physics majors, and mathematics majors. (3 q.h.)

124 Fundamental Laboratory Techniques in Chemistry - An introduction to Modern analytical and instrumental techniques in chemistry. (3 q.h.)

213 Chemistry of Drugs and Pollution - Chemistry as it relates to man and society, particularly drug chemistry, pollutants and toxic compounds. (4 q.h.)

255 Solution and Equilibrium Concepts - A study of solution properties, solubility products, activity concepts, complex on formation, volumetric and gravimetric techniques, nearest equation, and chemical equilibrium. (3 q.h.)

257 Basic Analytical Laboratory - Laboratory Techniques pertaining to volumetric and gravimetric analysis. (q.h. arranged)

315 Instrumental Techniques in Water Chemistry - An introduction to the instrumental techniques involved in the analysis of water samples, particularly as applied to pollution problems. (4 q.h.)

369 Radioisotopes - First principles of nuclear science, G.M. counting, gamma scintillation counting, gamma ray spectra, liquid scintillation counting, autoradiography, design of radiation on living systems. (5 q.h.)

Physics: 111, 112, 113 General Physics I, II, III - Principles of Physics and the phenomena underlying these principles. (4 q.h.)

301 Audio Acoustics - Nature production, and transmission of sound, acoustical properties and design of musical instruments, stereo systems, and auditoriums. Physical basis of musical tones, intervals, and scales. (3 q.h.)

365 Radiological Defense Principles - Plotting fallout, effects of radiation, techniques of handling millicurie level source. (1 q.h.)

468 Nuclear Physics - Nuclear structure. The shell model, spin-orbit coupling, configuration-mixing, ground state properties, and its application to nuclear decay, interaction, and reactions. (3 q.h.)

470 Special Problems in Physics - A program of individual study on some advanced area of some selected topics in Physics. (q.h. arranged)

Environmental Studies: 201 Field Visitation in Environmental Studies - Visitation to industrial sites, treatment facilities and laboratories throughout Minnesota for the purpose of understanding the scope of the environmental problems. (8 q.h.)

203 Internship in Environmental Studies - (q.h. arranged)

291 Seminar for Environmental Technicians - Staff and student presentations followed by group discussions of classic and current problems in environmental quality control. (2 q.h.)

300 Environmental Phytochemical Analysis - Study of laboratory techniques useful in assessing effects of environmental changes on the chemical composition of plants native to Minnesota. (3 q.h.)

301 Problems in Environmental Technology - Guided independent study of analytical techniques employed in the chemical and biological assessment of environmental quality. (1-4 q.h.)

401 (550) Pesticides in the Environment-W-S - Guided discussion and lectures on pesticides, their use, economic importance, biological hazards, and health implications. (3 s.h.)

601 Seminar - Interdisciplinary study and detailed dicussion of major areas of environmental controversy with emphasis on individual investigation of the available literature and effective oral presentation. (6 s.h.)

698 Graduate Research Paper - A documented report on the investigation of a significant environmental problem. Permission of the advisor is required. (3 s.h.)

INSTITUTION: DUKE UNIVERSITY

PROGRAM: Environmental Management

DEPARTMENT: School of Forestry and Environmental Studies

DEGREE: Master of Environmental Management (M.E.M.)

CONTACT: Dr. Robert L. Barnes, Professor
School of Forestry and Environmental Studies
Duke University
Durham, North Carolina 27706
(919) 684-2421

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The School of Forestry and Environmental Studies offers programs leading to the Master of Forestry (M.F.) or the Master of Environmental Management (M.E.M.). These are professional degrees intended mainly to provide students with the education and experience for careers in resource management. The M.E.M. program is specifically designed to train practicing environmental planners and managers. Emphasis is placed on developing and applying the ecological, socio-economic and political knowledge, management techniques, and philosophical outlooks basic to maintaining a high quality human environment. Although usually used as a terminal degree leading to professional employment, the M.E.M. can be used as a preface to doctoral work, law school, or other further education. The M.E.M. degree was approved in 1974.

The Master of Science (M.S.), Master of Arts (A.M.), and Doctor of Philosophy (Ph.D.) degrees are offered by the Department of Forestry and Environmental Studies of the Graduate School. These degrees are appropriate for the student who wishes to concentrate on a particular area of resource science or policy, with less emphasis on resource management. These graduates primarily enter teaching and research positions.

Available to students in the School of Forestry and Environmental Studies are laboratories, greenhouses, a phytotron with fifty separately controlled growth chambers, and Duke Forest, which is 8,500 acres of land used for field instruction and research in forestry and environmental problems. The school periodically sponsors conferences and symposia of interest and concern to persons involved in resource management.

The Duke Environmental Center allows students and faculty in the various departments and schools to expand upon research and learning activities in the environmental field. The purposes of the center are to focus attention on pressing environmental problems, to provide orientation and educational opportunities in environmental subjects, to promote interdisciplinary research, and to serve as a point of contact for the universities, environmental agencies, and the public. The center sponsors a visiting speaker program, graduate and faculty seminars, and courses in environmental studies. The research efforts of the center are aimed at the creation of multidisciplinary task forces in specific areas of environmental concern.

PROGRAM REQUIREMENTS

Students with a variety of undergraduate backgrounds are accepted into the M.E.M. program. Those whose prior academic background indicates a deficiency in the biological, quantitative, or social sciences can undertake remedial non-credit work in the area(s) question while in residence.

A maximum of sixty and a minimum of thirty semester units are required for the degree. During the first semester in residence, a faculty committee reviews undergraduate records to establish the number of units required for each student's program. A Cooperative College Program allows students to enter the program following the junior year; these students must complete sixty units in residence for the M.E.M. The degree program consists of a combination of regular courses, independent projects, seminars, and modular courses. A master's project of at least four but not more than eight units is required. Considerable latitude is allowed in electing courses to meet individual objectives; faculty advisors are assigned to students to explore options and help select courses of study. In addition to seminars and special studies, the school offers fifty-one courses in the areas of resource science; measurements, statistics and modeling; natural resource management; and natural resource policy.

All students, except those who have already had equivalent work, begin their programs with a four-week session in August which includes several modular courses. Included are topics in identification of flora and fauna, population parameters, sampling, data analysis, and environmental quality determinations. During a four-week period in May, a session is offered with a concentration on resource study and problem analysis in regions significantly different from the Durham area. Four credits can be earned during each of these sessions. Additionally, four courses, or twelve credits, are required courses. An internship program is being developed, in which students will spend three to six months, for up to twelve credits, with a public agency or private firm.

CURRENT FACULTY, STUDENTS, GRADUATES

Thirteen full-time and nine part-time faculty members comprise the school, contributing to the M.E.M. and M.F. degree programs. All participate in teaching and research. On the faculty is a diverse discipline representation, including forestry, biology, business, ecology, hydrology, mathematics, entomology, pathology, and civil engineering.

Forty-one students are currently enrolled in the M.E.M. program, and the annual number of graduates varies between fifteen and twenty. Graduate follow-up is carried out, which indicates that approximately 90 percent of the graduates become employed in the environmental field, primarily with governmental agencies.

PROGRAM PROJECTIONS

Program officials indicate a need for an expansion of research activity, and an increase of faculty. Specifically, three to four additional faculty members are needed in the areas of policy and economics. Additional funding will be required to meet these needs. The student enrollment is not projected or desired to increase at the present time.

COURSE DESCRIPTION

Required Courses:

211 Resource Ecology and Ecosystem Analysis - Introduction to ecological principles with emphasis on the ecosystem as a basic working unit. Land/water interactions, the patchiness concept, succession, energy flow, productivity, mineral cycling, perturbation effects on ecosystems, microclimate, and limiting factors. Field studies focus on team approach to analyze the biotic and abiotic components of the ecosystem and the effects of human use. (3 s.h.)

212 Population Ecology - Discussion of population dynamics of natural and exploited populations. A quantitative approach with emphasis on mathematical models and their application to population problems. (3 s.h.)

252 Quantitative Methods in Resource Management - Review of probability distributions, statistical inference, estimation. Basic and advanced regression analysis, design of experiments, analysis of variance with emphasis on problems of decision-making with experimental data. Design and development of computer based management information systems. (3 s.h.)

269 Resource Economics and Policy - The application of economic concepts to private and public sector decision-making concerning natural resources, especially renewable resources. Investment analysis, benefit-cost analysis. Planning and policy concepts. (3 s.h.)

Sample of Other Environmental Courses Available:

215 Air Pollution Meteorology - The theory of transport and diffusion of air pollutants and its application to practical problems and computations involving single and multiple sources; modeling of transport and diffusion, in wind tunnels and computers; stack design; the organization of meteorological networks and field studies; the measurement, monitoring, and equipment requirements of pertinent meteorological parameters; air pollution climatology; meteorological management of air pollution. (3 s.h.)

216 Watershed Hydrology - Influence of vegetation, soil types, and land forms on water yield, water quality, and flood potential. Analysis of precipitation patterns, infiltration rates, erosion forces, and sediment carrying capacities of streams. Techniques and research methods used to control the hydrologic cycle, water quality, and water yield on wild lands. (3 s.h.)

217 Environmental Intrumentation - Physical bases for measuring parameters of natural and controlled environments. Properties and effective utilization of contemporary electronic measurement and data acquisition systems. Methods for obtaining and processing computer compatible records. Precision measurement and calibration techniques with primary and secondary laboratory standards. (4 s.h.)

233 General Entomology - Principles of morphology, physiology, metamorphosis, and taxonomy of insects. (4 s.h.)

261 Soils and Forest Resources - Soil properties and morphology as related to land uses and management of forest environments. Interpretation of soil characteristics of importance to forest productivity and evaluation of effects of forest management practices on soil productivity and the quantity and quality of stream flow from upland and wetland forest watersheds. (3 s.h.)

273 Economics and Environmental Quality - Consideration of the economic dimensions of the environmental problem. Exploration of the reasons for market failure; investigation of possible remedies, including a tax on residuals and direct benefit and input-output analysis to incorporate environmental values. Discussion of economic growth, natural resource scarcity, environmental quality. (3 s.h.)

331 Toxicology of Insecticides - Study of the physical, chemical, and biological properties of material used to control insects. Formulation, toxicology, and insect physiology as related to insecticide action are emphasized. (3 s.h.)

342 Hydrologic Processes - Physical processes of the hydrologic cycle, with emphasis on those processes which can be modified or controlled by watershed management. (3 s.h.)

INSTITUTION: EVERGREEN STATE COLLEGE

PROGRAM: Environmental Studies

DEPARTMENT: Natural Sciences

DEGREE: Bachelor of Arts (B.A.) in Environmental Studies

CONTACT:
Dr. Edward J. Kormandy
Vice President and Provost
Dr. Oscar H. Soule
Associate Academic Dean
Evergreen State College
Olympia, Washington 98505
(206) 866-6000

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The Environmental Studies program at Evergreen State College is an example of an innovative approach to environmental education. Most institutions of higher education outline proposed sequences of curricula for students, and prepare catalogs with extensive, numbered course offerings. At Evergreen students and faculty embark upon cooperatively designed academic ventures. Programs are of three varieties: coordinated studies; group contracts; and, individual contracts. According to the Evergreen catalog supplement, 1977-78, these activities are defined:

> Coordinated Study: A group of faculty (usually four or five) and students (usually 60 to 100) studying a common theme or problem together using ideas and materials from several 'major fields' (disciplines).
>
> Group Contracts: A smaller type of program, usually one or two faculty with 25 to 45 students, involving in-depth study of a single topic. As a rule, only one or two 'major fields' (disciplines) are involved.
>
> Individual Contract: A type of advanced independent study."

Environmental studies, therefore, are undertaken at Evergreen under these parameters. The environmental studies program was initiated at Evergreen in 1972.

Each year, pursuant to the Evergreen philosophy of flexibility and change, a new set of coordinated studies, as well as, group contracts are developed. Students actively participate in the designing of these programs.

PROGRAM REQUIREMENTS

Students normally enroll in one of the Evergreen basic programs during the first two years. Then during the third and fourth years these students become involved in environmental studies. This is an interdisciplinary program involving the management of environmental resources, which includes protection, exploitation, and other comprehensive sets of experiences.

The environmental studies curriculum is usually offered each quarter in the form of one coordinated study, and one group contract. The following briefly describes the 1977-78 offerings:

Applied Environmental Studies: coordinated study, enrollment will be about 60 students. The major emphasis of the program will be the integration of ideas and methods from environmental chemistry, as related to specific environmental problems. Students will focus on three case studies, and work on the final report or presentation as agreed upon.

Environmental Law: group contract, enrollment will be about 20 students. The emphasis will be on environmental law, environmental politics and general social science.

Upon completion of a pre-agreed upon set of academic experiences, the student becomes eligible for the baccalaureate degree.

CURRENT FACULTY, STUDENTS, GRADUATES

The current faculty primarily responsible for the environmental studies program, consists of approximately 17 persons. Personnel from other departments, however, contribute depending upon the proposed program. In all, there are 120 faculty who may at one time interact with this program.

Enrollment in the environmental studies programs is approximately 170 students, of which 50% are male and 50% are female. Graduates of this program number approximately 30 students annually. Of these graduates, approximately 10% elect to pursue advanced degrees.

PROGRAM PROJECTIONS

Significant growth in the faculty and in the student population is not anticipated over the next few years. Faculty members associated with this program, characterize it as stabilized.

COURSE DESCRIPTION

There are no course descriptions available, in the usual sense. This is due to the innovative nature of this program, and in accordance to the fact that the modules of study are developed each year as the need arises.

INSTITUTION: FLORIDA INTERNATIONAL UNIVERSITY

PROGRAM: Environmental Studies

DEPARTMENT: Division of Physical Sciences

DEGREE: Bachelor of Arts (B.A.)
Bachelor of Science (B.S.)

CONTACT: Dr. John Parker, Associate Professor
Division of Physical Sciences
College of Arts and Sciences
Florida International University
Tamiami Trail
Miami, Florida 33199
(305) 552-2605

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The Environmental Studies curriculum was formed in 1972, at the time of the opening of Florida International University. The curriculum has undergone numerous changes since its inception. Two degrees are currently awarded: the Bachelor of Science (B.S.) and the Bachelor of Arts (B.A.). The B.A. program is aimed at lower to middle management positions in such fields as environmental education, environmental law, environmental management and planning, and outdoor recreation. As designed, students would be qualified for staff positions with environmental organizations and legislative-advisory groups. Students in the B.S. program are trained to be qualified for more technical and analytical work, such as laboratory analyses and the preparation of Environmental Impact Statements. Graduates of this program can enter specialized technical fields such as air or water pollution control, environmental health, energy resource development, environmental consulting, and technical work with parks and preserves. With both degrees, students are prepared to enter graduate level studies in related fields.

This multi-disciplinary program is carried out with the cooperation of a number of departments in the College of Arts and Sciences. These include: Political Sciences, International Relations, Sociology, Anthropology, Psychology, Economics, Physical Sciences, Biological Sciences, Mathematics, Philosophy, and Religious Studies. Faculty members from these disciplines provide support by teaching courses in and related to the Environmental Studies curriculum, participating in the Task Force on Environmental Studies, and contributing to special seminars and workshops that are held.

The main library of the university has an extensive section on environmental and urban affairs, and well-equipped laboratories are available for teaching and research. The Environmental Studies program is closely aligned with the Joint Center for Environmental and Urban Problems, which is operated by Florida International University and Florida Atlantic University. This center carries out research on applied aspects of particular areas. Current areas of research include resource recovery, ecological landscaping, land acquisition, energy conservation, and growth management. The center also conducts an ongoing lecture series which focuses on resource recovery, the hazards of nuclear waste, natural energy systems, and the preservation of wildlife.

Florida International University offers only upper division and graduate degree programs. The first two years of study are normally taken at community colleges. Florida law outlines course requirements at the lower division for transfer into upper division curriculums.

PROGRAM REQUIREMENTS

The Environmental Studies curriculums are currently undergoing revisions, as a result of recent recommendations of the Task Force on Environmental Studies. Recommended administrative revisions include further decentralizing of the program, appointing a full-time program coordinator, updating the student advisory program, coordinating course schedules, further publicizing the program, expanding and coordinating independent study projects, and establishing a College Council on Environmental Studies.

Recommended lower division preparation for the B.A. program includes the following courses: Natural History of South Florida, Conservation of Natural Resources, Man and Environment, College Algebra, Government and Politics of the United States, and Economics, Man, and Society. The latter three may be taken at FIU. Required courses at the upper division include fifteen quarter hours of Environmental Science, and each of the following five-hour courses: Environmental Economics, Environmental Politics, Man and Nature, Cultural Ecology, Colloquium, and an independent study or community project. Each student chooses a specialization from the following: Energy and Resource Management, Human Ecology, or International/Political Issues. Each student must take three approved courses from one of these areas; suggested courses are offered in a number of departments. Thirty hours of electives may be chosen, with a total of ninety quarter hours required for graduation.

Lower division preparation for the B.S. degree, according to the committee recommendations, includes the equivalent of eight semester hours of general biology and general chemistry, three semester hours of algebra and trigonometry, and the following recommended courses: General Physics, Physical Geology, Conservation of Natural Resources, Man and Environment, and Calculus. Additional lower or upper division requirements include courses in economics, politics, computers, and statistics. A core of nine courses, or forty-seven hours, are required in this program. These include the areas of ecology; environmental economics; environmental politics and policy; water, air, and energy resources; quantitative analysis or environmental instrumentation; and colloquium or independent study. Students in this program also choose an area of emphasis from the following: Energy and Resources, Aquatic Ecology, Terrestrial Ecology, and Air Resources. Courses are chosen in consultation with an advisor.

Approximately three students per year in Environmental Studies participate in a cooperative education internship for pay and academic credit. Most students are involved in this program for one quarter; those who continue a second quarter must write a report on the experience. Under this program, students are placed in industry or governmental agencies, such as the Everglades National Park or the National Forestry Service. The Joint Center has also hired several students as research assistants. Additionally, a scholarship is available to one Environmental Studies student each year, which provides one year's tuition.

CURRENT FACULTY, STUDENTS, GRADUATES

Twelve faculty members from the previously mentioned departments teach courses in the environmental curriculum. Only one is actually assigned to the program, on a part-time basis. There are an estimated forty students currently enrolled in the program; most of these work full-time and attend classes part-time. This figure includes both B.S. and B.A. candidates.

The number of students and annual graduates has increased since the program's inception, to the point that ten to twelve persons graduate in Environmental Studies each year. An increasing number opt to continue schooling in graduate programs, and many remain employed in their present jobs. An estimated 30 percent of the graduates become employed in an environmental field, entering the public and private sectors.

PROGRAM PROJECTIONS

Full implementation of the described curriculums and the achievement of all committee recommendations is a major goal of those involved with the Environmental Studies program. A full-time coordinator will be required, as well as the assistance of additional faculty members in other departments with expertise in the following areas: geology, terrestrial ecology, environmental biology, energy, and environmental psychology. Needs also exist for additional laboratory equipment. Faculty members believe that if all of the recommendations are implemented, the student enrollment in this program could double in several years.

COURSE DESCRIPTION

(Selected courses offered in Environmental Studies)

EVR 301 Environmental Science I - A course for non-science majors offering an introduction to the fundamental principles and concepts of ecology and to air pollution and water resources. (5 q.h.)

EVR 302 Environmental Science II - A course for non-science majors offering an introduction to the ecology of South Florida through lectures and a series of field trips into several unique ecosystems, such as the Everglades, hardwood hammocks, and coastal regions. Also natural resource conservation, wildlife management and ecology, and population dynamics. (5 q.h.)

EVR 412 Meteorology - The earth's atmosphere and its physical properties. General circulation and thermal structure of the atmosphere on a global and local scale. Physics and dynamics of clouds. Weather analysis and forecasting including temperate and tropical areas. Reading of weather maps. Introduction to meteorological instruments, transmission and plotting of meteorological data. (5 q.h.)

EVR 421 Water Resources - A seminar dealing with various aspects of water use, water pollution problems, chemistry and ecology of South Florida's waters. (5 q.h.)

EVR 431 Air Resources - Common air pollutants and their sources and methods of control. Different legislative and administrative approaches. (5 q.h.)

EVR 441 Energy Resources - Seminar dealing with power and energy production in modern society, fundamental energy relationships of industrial and domestic processes. (5 q.h.)

EVR 511 Air Pollution Dynamics - Designed to give an understanding of the fates of atmospheric pollutants. Scavenging processes in the atmosphere. Radiation. Residence times. Chemical reactions. Global transport process. Point source dispersion and modeling calculations. (5 q.h.)

INSTITUTION: INDIANA UNIVERSITY (IU)

PROGRAM: Environmental Programs

DEPARTMENT: School of Public and Environmental Affairs (SPEA)

DEGREE:
Certificate
Associate of Science (A.S.)
B.A./B.S.
Masters of Public Affairs (M.P.A.)
Masters of Science in Environmental Science (M.S.E.S.)
Ph.D. (minor)

CONTACT:
Dr. J. C. Randolph, Director
Environmental Programs
School of Public and Environmental Affairs
Indiana University
Bloomington, Indiana 47401
(812) 337-9485

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

Most of the environmental programs at IU emphasize the application of the environmental science to the policy-making process. The approach is solution-oriented. Students become specialists in particular aspects of environmental issues, yet have broad perspective in terms of technical abilities and socioeconomic concerns.

SPEA was formed in 1971 and offers:

Number of Degrees	Program	Additional Information
1	Certificate in Environmental Studies	Open to undergraduate students in all schools of the University, Requires 8-9 courses
1	Associate of Science (A.S.) in Public Affairs, Environmental Concentration	60 credits, 2 year program, 21 credits required for concentration
3	Bachelor: a) Bachelor of Arts (B.A.), Environmental Studies Major Program	Available to students in College of Arts & Science; need 25 hours in each major; no course duplication
	b) Bachelor of Science in Public Affairs (BSPA), Environmental Policy Concentration	Requires approximately 80 credits from SPEA, plus 8-9 courses for concentration

Number of Degrees	Program	Additional Information
	c) Bachelor of Science in Public Affairs (BSPA), Environmental Health Management Concentration	Requires approximately 80 credits from SPEA, plus 8 - 9 courses for concentration
1	Accelerated Masters: A five-year BA/BS-MSES Combined Program	Bachelors in Science or Mathematics and MSES degree
2	Masters	
	a) Master of Public Affairs, Environmental Policy Concentration	48 credits, interdisciplinary
	b) Master of Science in Environmental Science	48 credits, interdisciplinary
1	Ph.D.: Dissertation Minor in Environmental Studies	12 graduate credits related to Environmental Studies

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The program for the Certificate is designed to introduce students to selected aspects of current thinking and research on the nature, causes, and solutions of environmental problems.

The A.S. program is designed to augment the skills of individuals now employed in various public service occupations.

The B.A. program consists of a multidisciplinary study of the effects on the environment of population growth, resources utilization, energy generation, and agricultural systems. Two options are available: for students in biological or physical sciences or for students in social or behavioral sciences, or humanities.

The BSPA program provides specific skills to prepare students for work on environmentally related issues primarily at the state and local government levels. This concentration includes training in quantitative skills, organization theory and group behavior, and general public administration, combined with a concentration in environmental policy.

The Environmental Health Management Concentration examines the technical aspects of environmental health and their relationship to socioeconomic problems. Students are provided with a strong public policy background as well as exposure to relevant areas of the natural sciences and applied technology.

Admission to the Accelerated Masters is open to juniors with at least a 3.6 cumulative GPA who are majoring in a physical science, a biological science, or in mathematics.

The purpose of the MPA is to equip the student with the necessary skills and knowledge to enter professional positions in local, state, and federal government service, and in private industry.

The goal of the MSES is to produce a new kind of professional who combines specialization in a particular environmental science area with the administrative skills necessary for integrating this knowledge into a broader conceptual and operational framework.

A Ph.D. minor is available for any Indiana student with consent of his/her committee. The credits for this minor must be from two different disciplines outside the candidate's major department.

PROGRAM REQUIREMENTS

General undergraduate requirements of SPEA consist of approximately 80 credit hours. A concentration requires nine courses: chemistry or physics (1), physical systems of the environment, earth science or geology (1), environmental biology (1), seminar (1), environmental policy (1), mathematics (1), field biology, earth sciences, water resources, environmental social analyses (3).

MPA requirements are:

CORE courses	25 credits
Electives	2 - 5 credits
Concentration (e.g., Environmental Policy)	21 credits

MSES, which began in 1974, has the following requirements:

Basic Environmental Science	12 credits
Environmental Management & Policy	10 credits
Applied Environmental Science Concentration (e.g., environmental impact analysis, water resources)	20 credits
Professional Experience	6 credits

CURRENT FACULTY, STUDENTS, GRADUATES

Indiana University has eight campuses in its system; five offer the degrees mentioned in this narrative. A prospective student is advised to contact the individual campus that he/she wishes to attend for specific program details.

There are 13 faculty members working in SPEA Environmental Programs; nine in Bloomington, two in Indianapolis, and one in Gary. The environmental programs are administered by the Director of Environmental Programs and the Environmental Programs Committee.

Grants and contracts have been received from the EPA, U.S. Department of Interior, Department of Energy, United States Geographical Survey, National Science Foundation, Fish and Wildlife Service and the Indiana State Board of Health. They have been developed through the Environmental Systems Application Center. The Center conducts environmental research in applied ecology and natural resources, analyzes the impact of human activity on the natural environment, and is concerned with the socioeconomic, legal, and institutional aspects of environmental regulation and planning. Enrollment and graduate figures are:

Program	Enrollment	1976-77 Graduates
B.A./B.S.	95	31
M.S.E.S.	52	11
M.P.A. (Env. Policy Concen.)	25	8
Ph.D.	2	0

Approximately 60 percent of the M.S.E.S. graduate students receive financial assistance.

The Center for Public Affairs Service-Learning develops full-time paid internships in public agencies for the summer, fall and spring terms. Students participating in a public-service internship project receive six hours of academic credit and a stipend of $1,400 for graduate students. They are awarded on a competitive basis.

Summer internships in 1977 were with the Indiana State Board of Health, a private consulting firm in Indiana, and the EPA in Washington, D.C.

ADDITIONAL INFORMATION

Approximately ten mid-career federal administrators come annually to Indiana University for a year of graduate study. This program for government administrators was originally a result of a cooperative arrangement between Indiana University and the U.S. Civil Service Commission. The Program is associated with the School of Public and Environmental Affairs and the Graduate School of Indiana University. This program focuses upon the inter-relationships of science, technology and public policy.

COURSE DESCRIPTION (a partial listing of SPEA courses only)

Undergraduate:

V170 Public and Environmental Affairs - Broad coverage of public and environmental affairs through critical and analytic inquiry into selected policy areas. Attention is given to current as well as perennial public issues. (3 s.h.)

V262 Environment: Problems and Prospects - A survey of different aspects of the interaction between man and his environment, with an emphasis on the complex interactions within systems. Subjects discussed include population levels, natural resources, energy use, various types of pollution and means of controlling them. (3 s.h.)

V316 Environmental Health Management Orientation - An orientation to the broad concerns of environmental health management, including sanitation, stream pollution, air pollution, and food and drug control. Course includes an introduction to the programs and procedures involved with environmental health management. (3 s.h.)

V416 Environmental Health Management Seminar - Course designed for environmental health concentration students who have completed or are in the process of completing an internship and have completed V316 and chemistry requirements. Course consists of seminar-type discussion sessions and laboratory analysis practicum in applied environmental health problems. (3 s.h.)

E200 Environment and Man - An interdisciplinary examination of the problems of population, pollution, and natural resources and their implications for society. Usually presented as a series of lectures by faculty from several departments and schools. (3 s.h.)

E400 Topics in Environmental Studies - An interdisciplinary consideration of specific environmental topics. (2-3 s.h.)

Graduate courses:

V503 Public Affairs and the Environment - Begins from the approach that even though the public manager's decision-making is directed toward a specific service mission, the resultant decisions and policies often are accompanied by externalities that affect the physical environment. Analyzes many of the same policies examined in the Services course, but focuses on the externalities involved: effects on ecology, environmental health, and on urban and rural settings. (2 s.h.)

V510 The Political, Economic, and Regulatory Aspects of Environmental Control - A consideration of environmental policy-making from the perspectives of state, local, and national, political, economic, and regulatory factors. Alternative forms of environmental regulation are considered in the light of their political and economic feasibility and consequences. (2-3 s.h.)

V511 Environmental Systems Dynamics - This is a modeling seminar in which logical, particularly deductive, analysis and the synthesis of complex environmental systems are the focus. (3 s.h.)

V513 Energy and Material Residuals in the Environment - The interrelationship (technological and economic) among residuals, gaseous, liquid, solid, noise, heat and the activities appropriate to effective environmental quality management. (2-3 s.h.)

V514 Problems in Public Utilities Regulation and Management - Examines some of the more traditional issues of regulation, the logic behind economic regulation in government and the growing importance of environmental regulatory agencies with the rule-making, administrative, and adjudicatory powers. An examination of innovative regulatory approaches. (3 s.h.)

V520 Environmental and Social Systems - The interrelationships among social, technical, and natural systems. Theories of growth. Causes and implications of environmental problems. Alternative policies and mechanisms for environmental control and bases for choice. (3 s.h.)

V521 Environmental Science - Principles of environmental science, with emphasis on applicable principles of ecology. Environmental physics and chemistry, as well as applications to air and water pollution problems. Lecture, laboratory and field trips. (4 s.h.)

V526 Applied Mathematics for Environmental Science - Philosophy and techniques of mathematical modeling, with emphasis on practical applications. Numerical analysis, applied calculus, differential equations, system simulation. (3 s.h.)

V527 Applied Ecology - Ecosystem concepts in natural resource management. Techniques of ecosystem analysis. Principles and practices of ecological natural resource management. (3 s.h.)

V528 Applied Ecology Laboratory - Field techniques for quantitative analyses of ecosystems. Introduction to laboratory techniques for applied ecological research. (3 s.h.)

V536 Environmental Chemistry - Sampling methods and sample storage; environmental analytical methods and instruments; water, air, and soil quality and their measurement; special pollutant substances, their chemistry, sources, toxicological effects and analyses; industrial hygiene tests. (3 s.h.)

V537 Environmental Chemistry Laboratory - Experimental work in environmental chemical analysis to demonstrate analytical methods and instrumentation used in environmental laboratories, having reference to air, water, and soil quality. (3 s.h.)

V547 Applied Earth Science - Principles of the earth sciences and their applications to environmental analysis and management. Identification, quantification, and analysis of critical components of watershed systems. Interaction of human activities with the physical environment. (3 s.h.)

V548 Applied Earth Science Laboratory - Principles and methods of sampling, collection, measurement, analysis, interpretation of data concerning processes and features of the physical environment. Students will become familiar with field and laboratory equipment within the context of research projects. Emphasis is placed on practical application of basic techniques to real problems. (3 s.h.)

V549 Environmental Planning - The link between environmental quality and land use planning. Analytical and regulatory approaches for incorporating physical environmental concerns into everyday planning practice. NEPA and state environmental planning programs. Methods for assessing the physical and socioeconomic effects of community and regional development proposals for inclusion in Environmental Impact Statements. (3 s.h.)

V552 Environmental Engineering - Concerned with biological, chemical, physical, and engineering knowledge essential to the achievement of environmental quality objectives. Theory and design of unit operations and processes for air, water, and land pollution abatement. Emphasis on water quality control, industrial wastewater treatment, and solid waste management. (3 s.h.)

V553 Differential Equations in Environmental Science - Origin and methods for solving ordinary and partial differential equations for environmental science. Emphasis will be on equations for energy and mass transfer, but other topics will be considered. (3 s.h.)

V555 Topics in Environmental Science - Selected research and discussion topics in Environmental Science usually organized in a seminar format. (2-3 s.h.)

V579 Readings in Environmental Science - Readings on selected topics in environmental science to be arranged with the individual instructor. (cr. arr.)

V589 Practicum in Environmental Science - Students hold work assignments with public agencies; final product such as a report, oral examination, or examples of materials developed in the Practicum is required. (3 s.h.)

V620 Environmental Analysis Workshop - Projects in environmental analysis. (1-3 s.h.)

V625 Research in Environmental Science - Research on selected topics in environmental science to be arranged with the individual instructor. (1-6 s.h.)

INSTITUTION: IOWA STATE UNIVERSITY (ISU)

PROGRAM: Environmental Studies

DEPARTMENT: Interdisciplinary

DEGREE: Bachelor of Arts (B.A.)
Bachelor of Science (B.S.)

CONTACT: Dr. Craig Davis
141 Bessey Hall
Iowa State University
Ames, Iowa 50011
(515) 294-7252

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The Environmental Studies Program is designed for all students interested in improving their understanding of environmental problems and for students desiring careers in environmental science, environmental technology, environmental planning and management, environmental assessment, or environmental education. The Program is designed to give the student an appreciation of the environment and an overview of environmental problems and their solutions. The environmental studies program is meant to supplement the students' disciplinary major. The structure and atomsphere of the Program are designed to provide an atmosphere in which interdisciplinary breadth may be combined with disciplinary depth in the quest for solutions to environmental problems.

The policy making body of the interdisciplinary Environmental Studies Program is the Council for Environmental Studies. This is a committee of ten persons appointed by the Vice-president for Academic Affairs. Six members represent each of the Deans of the six academic colleges. Other members include the Coordinator of Environmental Studies and representatives of the University Extension Service and the Government of the Student Body. The Chairman is an ad hoc appointee and may come from any college.

PROGRAM REQUIREMENTS

A student may major in any department of the university and still participate in the Environmental Studies Program. S/he is required to take a sequence of three introductory team taught courses. "A Workshop in Environmental Impact Analysis" is required during the senior year. These four courses (15 credits) form the "CORE" of the program.

With assistance from a faculty sponsor, the student develops an environmental Area of Emphasis (AOE) that is 30 credits long. The student meets with the Council, justifying each of the courses s/he has chosen for his/her AOE. Approximately one in four programs is initially approved without revision. Presently there are 136 courses from 32 departments that have been approved by the Council for inclusion in AOEs. Students are also encouraged to incorporate independent study projects into their AOEs.

CURRENT FACULTY, STUDENTS, GRADUATES

Two faculty members are employed full-time--one is the coordinator and the second is an extension specialist. This second position was new in 1977. Working with the Department of Public Instruction, small workshops are conducted for teachers in Environmental Studies off-campus. Credit for these sessions can be applied to a degree program.

Other courses are taught by professors from various departments either as part of their regular classroom responsibility or as overload.

It is difficult to state exactly how many students are taking courses; sixty have filed AOEs with the Council. It is hoped that this number will grow to 100 in the near future. Upon completion of the program, a memo from the Environmental Studies office is sent to the registrar who records on the transcript completion of the program.

Some opportunities have existed in the past for students to have a work experience with the Department of Transportation, Department of Environmental Quality, state legislature, or 4-H.

Graduates usually find their own employment through their disciplinary major but the fact that they can write impact statements and do environmental assessments has been extremely helpful in gaining employment.

PROGRAM PROJECTIONS

The University Curriculum Committee in March of 1977, approved Environmental Studies as a co-major. The Council on Interdisciplinary Studies is presently working on the administrative questions concerning the relationship of the co-major to the various colleges.

A proposal for a graduate program in Environmental Studies is being prepared for submission to the Graduate Dean during the 1977-78 academic year.

ADDITIONAL INFORMATION

In April, 1977, a national workshop on experiential learning in undergraduate environmental studies was held in Estes Park, Colorado. Sponsors were Iowa State University Environmental Studies Program, the St. Lawrence University Environmental Studies Program and the National Association for Environmental Education. Dr. Davis directed 41 participants from colleges, universities and government agencies to define, describe, evaluate and make recommendations concerning the use of experiential learning methodologies in undergraduate environmental studies.

Two summer institutes have been held dealing with wastewater treatment for teachers. Academic seminars, ten weeks in length, are held twice a year.

The Governor's Environmental and Conservation Education Conference was held at Iowa State University in August, 1977. The proposal was made that all grades, instead of the required K-6, have Environmental Education in their curriculum.

COURSE DESCRIPTION (a partial listing)

Core courses:

University Studies 221 Man and the Environment - an introduction to environmental science. Emphasis is on understanding the complexity of the environment and of environmental problems. Major topics covered include principles of ecology, resource economics, and entropy. (3 q.h.)

University Studies 222 Man and the Environment - an investigation of environmental problems associated with human population growth, resource depletion, pollution, and energy production and consumption. (3 q.h.)

University Studies 223 Man and the Environment - emphasis is on the moral and ethical aspects of energy production and consumption and the problems and processes of environmental decision making as influenced by cultural, social, and political forces. (3 q.h.)

University Studies 391 Seminar in Environmental Studies - seminar discussions of various topics of environmental concern. This course may be repeated for credit. Environmental studies students must take at least one seminar each year. (1 q.h.)

University Studies 421 Workshop in Environmental Impact - a task force approach to the review of environmental policy, the assessment of environmental impact and the preparation of environmental impact statements. (3 q.h.)

Electives: (a partial listing)

Agricultural Mechanization: 306 Soil and Water Management - Soil and water conservation. Surveying measurements. Land description. Planning erosion control and drainage facilities. Field trips. (3 q.h.)

480 Intermediate Technology - The philosophy and use of intermediate technology in the developing countries. Availability of plans and specifications of equipment. Case studies of use of appropriate technology. Evaluation of the effects of intermediate technology on culture and economic livelihood of peasant farmers. (3 q.h.)

Agronomy: 415 World Crops: Adaptation and Distribution - Origin and adaptation of crop plants. Influence of environmental factors on distribution and production of cereal, oil, fiber, sugar, and other crops. (3 q.h.)

Animal Ecology: 530 Wildlife Pollution Ecology - Biologic relationships between wild terrestrial vertebrates and environmental pollutants. Aspects of source, occurrence, persistence, toxicity, ecosystem dynamics, and rate of degradation of pollutants. (3 q.h.)

Architecture: 472 Man-Environmental Relations - An exploration of the multidisciplinary dimensions of man's interaction with the physical environment. Introduction to empirical data gathering methods. Integration of human behavioral factors in the design process. (3 q.h.)

Biology: 104 Life and Environment - Laboratory and field investigations of biological principles, emphasizing relationships between organisms and environment. Application of ecological principles to contemporary environmental problems. For non-majors only. (2 q.h.)

Botany and Plant Pathology: 304 Plants and Man - Interactions of plants and man. Plants, the origin and development of human cultures. Plants and man's needs: food, industrial products, medicines. Plants and the future--food, energy needs, and the changing environment. (4 q.h.)

Chemical Engineering: 531 Air Pollution - Fundamentals of the formation, dispersion, and effects of air pollutants. Air quality standards. Sampling and analysis of pollutants from stacks. Introduction to control methods. For students in engineering and the physical sciences. (3 q.h.)

Civil Engineering: 328 Sanitary Engineering in Environmental Control - The sanitary engineer's responsibility in protecting public health through environmental control of communicable diseases, air pollution, and solid wastes. Organization, administration, and operation of regulatory agencies. (3 q.h.)

Earth Sciences (Geology): 207 Geologic Environment and Hazards - Application of basic geological concepts and principles to the analysis of the interaction between man and the geologic environment, volcanoes, ground water, construction sites, and land use patterns. (3 q.h.)

Economics: 380 Economics of Natural Resources and Environmental Quality - Natural resource availability, use, conservation, and control; environmental implications and pollution control policies. Primarily for undergraduate students not majoring in economics or agricultural business. (3 q.h.)

English: 359 The American Environment in Literature - Growth and development of the concept of the environment as a totality of which man is a contributing part. Focus on American writers of literary distinction for whom this concept has been significant, from Colonial to Modern period, with emphasis on twentieth-century figures. (3 q.h.)

Family Environment: 185 Families and Their Environment - Exploration of the social, economic, physical, and aesthetic dimensions of family environment. (3 q.h.)

Food Technology: 398 Seminar on the World Food Problem - Study of the task of providing food for the world's population. Class discussion based on readings in population growth, food production, availability of plant and animal proteins, new foods, food supplements, nutrition and barriers to agricultural development. (2 q.h.)

Forestry: 200 Forest Conservation - Evolution of forest conservation in the United States. Current public and private conservation policies. Forests in relation to human needs; conflicts between uses of forest resources. (3 q.h.)

History: 435 Science in American Society - Science and its social relationships in America since about 1840; impact of Darwinism, Freudianism, scientific racism; the new biology and other sciences; modern medicine; the social sciences; science and industry; science and war; environmental and energy crises; decline of basic research. (3 q.h.)

Industrial Administration: 360 Principles of Transportation - Historical development and current role of transportation in the United States. Economic problems and public policy pertaining to transportation agencies; emphasis on the railroads. (3 q.h.)

Landscape Architecture: 411 Land Analysis - Analysis of the physical and biological processes of land. Investigations are made of limiting factors and opportunities as these are employed in planning and design for human use. Instruction includes visiting professors from allied fields. (4 q.h.)

Mechanical Engineering: 434 History of American Technology - Sources of American invention and its relation to science; social and economic determinants of technological innovation; effect of the entrepreneur and corporate business structure of American technology. (3 q.h.)

Nuclear Engineering: 462 Elements of Nuclear Engineering - Energy generation and removal, fuels, shielding and containment, mechanical and structural components, reactor systems, power costs, waste disposal and reprocessing. Laboratory: Fluid flow, inspection, quality assurance, reactor lab, activation analysis, slowing down distance, power plant simulations. (4 q.h.)

Physics: 350 Energy and the Environment - Topics of current interest in energy use, development, and conservation. Discussion of research, future energy alternatives, effects of environment. (3 q.h.)

Political Science: 483 Environmental Quality Policies - Political issues and policy alternatives relative to environmental pollution; structure and output of environmental agencies at national, state, and local governmental levels. (3 q.h.)

Sociology and Anthropology (Sociology): 482 Social Behavior and Environmental Resources - Natural resource problems, value orientations toward the environment, environmental quality and quantity as social problems, conservation as a social movement, organizational patterns in resources management. (3 q.h.)

INSTITUTION: MACALESTER COLLEGE

PROGRAM: Environmental Studies

DEPARTMENT: Interdepartmental

DEGREE: Bachelor of Arts (B.A.)
Bachelor of Science (B.S.)

CONTACT: Dr. James (Al) Jones
Biology Department
Macalester College
St. Paul, Minnesota 55105
(612) 647-6272

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The goal of the interdepartmental major concentration in Environmental Studies, which began in 1972, is to provide students with the background they need for a broad but basic understanding of environmental processes and issues. The major includes a foundation in the physical and life sciences, and study of the ways in which individuals and societies react to and influence their environment. Thus the major concentration recognizes two directions to environmental study: a natural science focus (biology, chemistry, geography, geology and physics), and a social science focus (anthropology, economics, geography, political science and sociology).

PROGRAM REQUIREMENTS

General admission requirements to Macalester are:

1) Graduation from a secondary school with a scholastic record and test scores which indicate that the student is likely to succeed in college.

2) SAT test of the College Entrance Examination Board, or the ACT test of the American College Testing Program.

3) Recommendation as to personal commitment and intellectual ability by the student's adviser or college counselor.

4) Additional evidence regarding the student's intellectual curiosity and academic potential, creativity and personal qualities. (Two such personal recommendations.)

The interdepartmental major in Environmental Studies consists of 14 courses. Details of the program are:

1) Four introductory courses
    a) Required of all students: Biology 11, Principles; Geology 11, Physical; and
    b) Required of students with a natural science focus: Chemistry 11 or 13, General; Geography 26, Physical; or
    c) Required of students with a social science focus: Economics 11, Principles; Geography 11, Human.
2) Five or six primary department specialization courses - Students are required to present an approved group of six courses in one of the following academic departments: anthropology, biology, chemistry, economics, geography, geology, physics political science, or sociology.

3) Two or three secondary support courses from anthropology, biology, chemistry, economics, geography, geology, physics, or political science.

4) Two Environmental Studies courses (internship and senior seminar).

CURRENT FACULTY, STUDENTS, GRADUATES

New freshmen are exposed to the program during orientation. An Environmental Studies seminar was attended by 21 students during the fall of 1977.

During the junior year or the first semester of the senior year, a part-time internship for one credit is required. Students are responsible for finding these positions. Past internships have been with a local planning department, the state game and fish department and the copper nickel project in northern Minnesota.

The five members of the Environmental Studies Committee are from the chemistry, political science and geography departments. The emphasis is on teaching, not research.

Summer workshops are held for elementary teachers, usually in biology.

PROGRAM PROJECTIONS

It is the feeling of the faculty that the Environmental Studies student must become more of a specialist and so no change is seen in the program's long-range goals and objectives.

COURSE DESCRIPTION

(the following is a partial listing of courses)

11 Principles of Biology - An introductory course considering fundamentals and concepts of biology in terms of historical background and with emphasis on modern developments. No prerequisite. (3 s.h.)

11 Physical Geology - Materials and structure of the earth. Processes acting on and in the crust of the earth to produce change. Origin of land-forms. Local field trips. (3 s.h.)

11 General Chemistry - An introduction to the principles of chemistry. The chemical and physical properties of substances are considered and related to the atomic, kinetic and equilibrium theories. (3 s.h.)

26 Physical Geography - Human land use and settlement patterns in their physical environment. Weather and climate, microclimatology and pollution, water-balance, soils and vegetation, on local and world regional scales. Landscape erosion (Geomorphology) with particular emphasis on Anglo-America. Field trips to contrasting environments in local region. Map and air photo laboratory sessions. (3 s.h.)

11 Principles of Economics - An introduction to elementary economic analysis with applications to a range of problems such as inflation, unemployment, farm price supports, balance of payments difficulties, poverty and distribution of income. (3 s.h.)

11 Human Geography - Introduction to the basic concepts and fundamental questions of geography. Major topics covered will be human perception of earth space and spatial ordering systems; the growth and distribution of human population, the localization and functioning of primary circulation systems on the surface of the earth; human ecology and man's perception of his environment; principles of the analysis of spatial diffusion. (3 s.h.)

88 Senior Seminar on Environmental Problems - A course for seniors in the Environmental Studies concentration focusing in detail on selected environmental topics. Students will use the knowledge and methods learned in other courses to analyze a particular problem or group of problems. This course will be team-taught and will attempt to bring together the perspectives of the natural sciences and the social sciences. The course will not satisfy distribution requirements in natural or social science. Prerequisite, senior standing and satifactory progress in the Environmental Studies concentration. (3 s.h.)

11 Cultural Anthropology - The cultural perspective on human behavior including case studies, often illustrated by motion pictures or slides, of non-Western and American cultures. Includes some field interviewing and the cross-cultural treatment of social, economic, legal, political and religious institutions. Survey of major approaches to the explanation of cultural variety and human nature. (3 s.h.)

60 Urban Anthropology A - Survey of anthropological approaches to the study of urban culture. Selected anthropological studies of urban cultures will be examined. The experience of living in cities and the nature of cities will be discussed from a cultural perspective. (3 s.h.)

40 Field Zoology - A study of the local fauna, including phylogenetic relationships, taxonomy, life histories, distribution and behavior. The importance of these animals economically, ecologically, aesthetically, and in human health, is emphasized. Study of natural groups of animals in the laboratory is followed by extensive field observations. (3 s.h.)

41 Ecology - A study of natural communities and the principles which underlie their structure and change. The physical factors of the environment, population dynamics, energy flow and conservation are emphasized. (3 s.h.)

65 Advanced Botany - An intensive study of field and ethnobotany. Systematic, evolutionary and ecological relationships of vascular plants will be stressed. A "Plants and Human Affairs" approach will be followed and a knowledge of the local flora will be developed by use of lectures, laboratory and field work. (3 s.h.)

23 Analytical Chemistry - Application of chemical principles to problems in chemical analysis. Laboratory work includes volumetric, gravimetric and instrumental methods for quantitative analysis. (3 s.h.)

37 Organic Chemistry - The carbon compounds, their structures, reactions and syntheses. (3 s.h.)

51 Intermediate Micro Economic Analysis - Methodology of economic science; theory of the firm; market structure and price determination; income distribution; general equilibrium analysis. (3 s.h.)

58 Public Finance - Economic analysis of sources of government revenues and types of public expenditures; applications of public sector decision-making models to the determination of public expenditure patterns; the impact of public expenditures on wealth distribution and resource allocation; the impact of different methods of taxation on resource allocation and wealth distribution; principles of deficit finance; cost-benefit

58 (cont'd) - analysis as applied to public project evaluation; state and local fiscal problems; fiscal policy. (3 s.h.)

41 Urban Geography - A discussion of the phenomena of urbanization in relation to patterns of circulation and distribution of resources. Study of models and theories useful in urban geography and their relation to the contemporary city with focus on the Twin Cities and their hinterland. A survey of major world cities. An examination of problems confronting cities and attempts at their solution. Field work required. (3 s.h.)

55 Advanced Physical Geography: Environmental Management - Elements of weather and climate and their basic controls; mechanisms of the general circulation of the atmosphere; weather disturbance in middle latitudes; description and analysis of climatic types. (3 s.h.)

22 Water Resources - Analysis of the hydrologic cycle, including study of precipitation, runoff, evapotranspiration, infiltration and groundwater flow. Physical and chemical properties of water. Water pollution studies from a scientific (rather than political) viewpoint. Problems of water management. (3 s.h.)

67 Economic Geology - Occurrence, characteristics and origin of mineral desposits. Factors controlling the distribution of elements in the earth's crust. Relation of mineral deposit theory to problems of mineral economics, discovery and evaluation of deposits. Field trip to mining regions. (3 s.h.)

10 The Physics of Sound - Musical acoustics, the physics of musical instruments and technical applications of sound; experiments in sound are included. (3 s.h.)

21 Introductory Physics I - Mechanics, heat and sound, including laboratory experiments and extensive demonstrations. (3 s.h.)

22 Introductory Physics II - Electricity and magnetism, light and optics, modern physics, including laboratory experiments and extensive demonstrations. (3 s.h.)

25 Introductory Modern Physics - This course is designed for entering students who are considering the possibility of studying physics in some depth during their college careers. It assumes a high school level background in physics and builds on this background as it considers the topics which are at the heart of modern physics: 1) space, time and cosmology, as described by the theories of special and general relativity; 2) atomic properties, as described by the wave theory of matter and quantum mechanics, and 3) nuclear and elementary

25 (cont'd) - particle properties, as they are currently understood. Through the use of analogies, pictorial and graphical representations, and a reliance on experimental results, these fascinating areas are discussed on a level that is accessible to science-oriented students who may not have a background in calculus. An introduction to computer use is an integral part of the laboratory portion of this course. (3 s.h.)

26 Principles of Physics I - Mechanics, heat and sound, including laboratory experiment and extensive demonstrations. Presupposes a working knowledge of calculus. (3 s.h.)

27 Principles of Physics II - Electricity and magnetism, light and optics, modern physics, including laboratory experiments and extensive demonstrations. Presupposes a working knowledge of calculus. (3 s.h.)

11 Politics and Social Change - An introduction to political science with emphasis on American public policy problems, policy analysis and relationships to social change. (3 s.h.)

47 Intergovernmental Relations - The role of federal agencies and policies, state consittutions, city charters, governors, mayors, judges, state legislatures, city councils, county commissions and metropolitan authorities in governing state, city, county, township and special districts. (3 s.h.)

20 Analysis of Society - Survey of principal concepts and methods with emphasis on sociology as a mode of analysis or way of knowing. Study of individual, collective and institutional behavior using materials largely drawn from contemporary American society. (3 s.h.)

66 Urban Social Structures - A - Main focus on contempory urbanism with an emphasis on urban social institutions, value systems and social change. Examination of contemporary urban culture and its identity seekers including a macro-level analysis of structural changes in institutions and stratification systems. (3 s.h.)

INSTITUTION: MIAMI UNIVERSITY (OHIO)

PROGRAM: Environmental Sciences
DEPARTMENT: Institute of Environmental Sciences (interdepartmental)
DEGREE: Master of Environmental Science

CONTACT:
Dr. Gene E. Willeke, Director
Institute of Environmental Sciences
Miami University
Taylor Road
Oxford, Ohio 45056
(513) 529-2732

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The Institute of Environmental Sciences at Miami University, established in 1969, offers a master's degree program that is interdisciplinary in nature. Areas of concentration include: air quality, applied ecology, communication, educational media, energy, environmental education, environmental simulation and impact analysis, environmental technology, ethology, interpretive ecology, policy making and administration, recreational planning and development, urban and regional analysis, and water resources.

In addition to coursework and a first year's experience in a community service project, students must fulfill one of three research options (practicum, internship or thesis) concerned with solving a real-world environmental problem.

A number of organizations and agencies have developed formal and semi-formal internship arrangements with the Institute. Among these groups are Argonne National Laboratories, Battelle-Columbus Laboratories, Environment Control Corporation, the Miami Conservancy District, Montgomery County School System, National Center for Atmospheric Research, National Park Service, Newton Fish Toxicology Laboratory, Ohio Department of Natural Resources, Ohio Department of Transportation, Preble County Historical Society, Scripps Foundation, Southern Illinois University Outdoor Laboratory, U.S. Environmental Protection Agency, U.S. Geological Survey, Vermont Agency of Environmental Conservation, West Michigan Shoreline Regional Development Commission, and several private corporations.

Facilities at Miami Universtiy include: the Environmental Sciences Center located on a 14-acre former Nike launchers site; the Information Center which provides environmental reference materials and library facilities; (future plans call for making the Information Center an environmental information and referral center for the southwestern Ohio region.); a Data Analysis Room designed to house a terminal for the Southwestern Ohio Regional Computer Center; an instrumentation laboratory; an electronic laboratory/machine shop capable of building almost any prototype device or model from a feasible plan. The McGuffey Laboratory School offers IES students the opportunity for input in the development and implementation of an environmental education curriculum.

Five natural areas in close proximity to Oxford are used extensively by the IES participants for "studies regarding ecosystem analysis, resource management, and environmental education"; the Bachelor Wildlife Estate; the Estate and adjacent Brown Tract; the Bachelor Estate Ecology Research Center; the 120-acre field station at the Brookville Reservoir is used jointly by IES and Earlham College (Richmond, Indiana); the Hueston Woods State Park.

The Institute has several grants pending with the U.S. Department of Energy, U.S. Office of Education, and the National Science Foundation. There are tentative long-term plans for a relationship with Monsanto in which industry and university will share research capabilities in pollution studies. Three grants have been received this year from the Energy Research and Development Administration, the National Science Foundation, and the U.S. Environmental Protection Agency for teacher training and research on the environmental effects of sludge disposal on land.

Student involvement characterizes a community contract to plan the Great Miami Corridor as well as environmental education outreach programs for school personnel and/or the public in nearby Oxford, Hamilton, and Cincinnati. The Institute sponsored a Symposium on Environmental Education and Research in September, 1977, and co-sponsors an annual conference on environmental issues with other agencies and universities in the state.

PROGRAM REQUIREMENTS

Admission requirements for the IES program include a cumulative grade-point average of 2.75 (4.00 system) in the last two undergraduate years; letters of recommendation; the Miller Analogies Test; a letter outlining one's reasons for and expectations in applying; and a competency in statistics and computer applications (may be met in the first semester in the program). Students from all traditional disciplines are considered for admission.

Requirements for the M. En. degree include a minimum of 15 hours in IES core courses, 13 hours minimum in specialty electives, and 6 hours minimum parcticum-internship-thesis credit. Students take a comprehensive examination integrating the core course material and must submit an approved experimental design of the practicum-internship-thesis and defend that project upon completion, including presentation in an open seminar.

CURRENT FACULTY, STUDENTS, GRADUATES

The IES is centrally administered by an Executive Committee (Director, two Deputy Directors, six IES elected members, the Advisory Committee chairman, and two peer-elected students) that serves as the planning and policy-making body of the Institute. The Advisory Committee (30 individuals) is composed of one member from each department which has shown interest in the Institute. Core-course coordinators (6-10) are responsible for the organization and smooth operation of the core courses. The following departments and/or academic organizations are actively involved in the IES: Academic Computer Service, Accountancy, Aeronautics, Architecture, Art, Botany, Chemistry, Communications and Theatre, Economics, Educational Leadership, Educational Psychology, Engineering Technology, English, Geography, Geology, History, Industrial Education, Management, Mathematics and Statistics, Microbiology, Nursing, Philosophy, Physical Education (Men and Women), Physics, Political Science, Psychology, Pulp and Paper Technology, Scripps Foundation, Sociology and Anthropology, Spanish and Portuguese, Systems Analysis, Teacher Education, Western College, and Zoology.

There are nineteen first-year and thirty second-year M.En. students currently enrolled in the Environmental Sciences program. The average number of graduates annually has been about twelve. Detailed follow-up records indicate that students have been placed in a variety of occupations--government (43 percent), university or teaching (29 percent), consulting (12 percent), private sector organizations (9 percent), and industry (7 percent).

Financial aid to students comes primarily in the form of teaching and research assistantships from IES, various departments, intramural recreation, women's resource center, residence halls, Peffer Western Environmental Education Program, and externally funded research projects.

PROGRAM PROJECTIONS

Research and outreach by the Institute of Environmental Sciences at Miami University will depend in large measure on funding from the state legislature. Training grants from the Environmental Protection Agency are critical if students are to be supported at the graduate level; but grants designated for specific disciplines, do not lend much-needed aid to process-education-oriented programs such as the Institute of Environmental Sciences.

COURSE DESCRIPTION

Core Curriculum:

IES 531 Introduction to Environmental Science - To analyze the relationship of man to his environment, specifically the assessment of his impact on the environment as a whole. The course attempts to outline the evolution and present status of many of our environmental problems, presents possible solutions, and attempts to predict man's future relationship with nature. (3 s.h.)

IES 601 Environmental Measurements - A laboratory course in the basic systems and techniques used to measure environmental parameters. Topics include remote sensing, aquatic systems, air pollution, radioactivity, and terrestrial systems. (1 s.h.)

IES 611 Environmental Methodology - An overview of the IES program and review of the goals and objectives of various pertinent disciplines as they contribute to a better understanding of the environmental dilemma. Practice in solving real-world problems is initiated by dividing the class into small teams to evaluate and offer alternative solutions to local environmental problems. (3 s.h.)

IES 612 Environmental Analysis and Modeling - To acquaint graduate students with the various methods of data analysis, forecasting, and the building and use of computer simulation and optimization models for analysis and solution of environmental problems. (4 s.h.)

IES 613 Environmental Policy Making and Administration - To introduce graduate students to the problems and techniques of promulgating and implementing the solutions to environmental problems, specifically the various requirements of policy making and implementation in the private and public institutions of society. (3 s.h.)

IES 620 Topic Seminar - A seminar on professional techniques of environmental science with special emphasis on information retrieval research presentation, and environmental impact statements. (1 s.h.)

IES 660 Advanced Topic Seminar - Discussion of relevant environmental problems under the direction of faculty competent and interested in the specific topics under consideration. (1 s.h.)

IES 670 Environmental Practicum - To provide the advanced graduate student with the opportunity to work as a member of a team in applying acquired knowledge to the solution of an environmental problem. (6-12 s.h.)

IES 680 Environmental Internship - To provide the advanced graduate student with the opportunity to apply acquired knowledge while working for approximately six months with an appropriate sponsoring organization which is actively involved in interdisciplinary environmental activities. (6-12 s.h.)

IES 690 Special Problems in Environmental Science - Independent or team research on a current environmental problem. (1-6 s.h.)

Air Quality Concentration (required courses and electives):

General Chemistry
Quantitative Analysis
General Physics
Multi-dimensional Calculus
Meteorology
Geography of Energy Resources
Industrial Geography
Climatology
Probability and Statistics
Water and Air Analysis Laboratory
Spectroscopic Identification of Structure
Physical Chemistry
Nuclear and Radiochemistry
Advanced Analytical Chemistry
Environmental Engineering
Environmental Topics in Modern Physics
Material and Energy Balances
Unit Operations

Energy Concentration (required courses):

Introduction to Environmental Science
Methods of Teaching Environmental Education
Laboratory Practicum in Environmental Science Education
Curriculum Development in Environmental Education
Seminar in Environmental Education

Hazardous and Toxic Substances Concentration (required courses and electives):

College Chemistry
Organic Chemistry
Quantitative Analysis
General Physics
General Microbiology
General Physiology
Advanced Analytical Chemistry
Applied Microbiology
Environmental Physiology
Toxicology I
Toxicology II
Environmental Health Seminar
Environmental Hygiene Technology
Chemical Carcinogenesis
Spectroscopic Identification of Structure
Biochemistry
Biochemical Techniques
Nuclear and Radiochemistry
Organic Principles and Theory
Organic Synthetic Methods
Pathogenic Microbiology
Comparative Animal Physiology
Neuromuscular Physiology
Fundamentals of Cytology
Biochemical Genetics
Limnology
Nutrition and Cancer

Water Resources Concentration (required courses and electives):

Quantitative Analysis
Ground Water Geology
Material and Energy Balances
Fundamentals of Ecology
Limnology
Unit Operations
Advanced Analytical Chemistry
Phycology
Ground Water Hydraulics and Development
Water and Air Analysis Laboratory
Environmental Engineering
Invertebrate Zoology
Icthiology
Analytical Absorption Spectrophotometry

INSTITUTION: MICHIGAN STATE UNIVERSITY (MSU)

PROGRAM: Natural Resources and Environmental Education, Environmental Conservation Education (NREE)
DEPARTMENT: College of Agriculture and Natural Resources
DEGREE: Bachelor of Science in Natural Resources & Environmental Education (B.S.)
Master of Science in Environmental Conservation Education(M.S.)
Doctor of Philosophy in Environmental Conservation Education (Ph.D.)
CONTACT: Dr. David Johnson, Coordinator
Natural Resources and Environmental Education
Department of Fisheries and Wildlife
Michigan State University
East Lansing, Michigan 48824
(517) 355-4477

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

Instituted in 1972, the undergraduate program in Natural Resources and Environmental Education prepares students for work as professional teachers or communicators in formal and informal settings. A broad curriculum in natural resources and environmental areas is supplemented by coursework designed to meet the student's individual interests. Accordingly, students may enroll in this program through the Department of Fisheries and Wildlife, Forestry, Parks and Recreation Resources, or Resource Development. The program is housed in the College of Agriculture and Natural Resources--a placement that allows it an experiential orientation.

With the increasing number of courses in conservation, ecology, resource management, and environmental sciences at the secondary and junior college levels, the job market for graduates of this NREE program is expanding. Employment opportunities exist in educational camping programs, interpretive centers, and community education centers as well as in the Cooperative Extension Service, Departments of Health and Natural Resources, federal and state agencies, private foundations and clubs, municipal and regional planning agencies, and industry. Undergraduate majors complete a salaried internship program as part of their course of study during which they are to be regarded as professionals by their employers. (There are no internships in the school systems.)

The program in Natural Resources and Environmental Education also offers two-week mini-courses on a variety of topics to give Michigan State students in general an exposure to natural resources and environmental concerns. Two Youth Conservation Corps courses provide students with experience and training relative to this particular field setting, and week-long seminars in the public schools are provided by NREE students.

Research funding comes from the National Wildlife Federation, SEA Grant program (Great Lakes study), Environmental Protection Agency, and 4-H organization (three extension people work with 4-H in environmental education). There are laboratory facilities available to students, but the thrust of the program in environmental education is toward the field and away from the lab. Consequently, the students and staff in NREE receive much support from the College of Education and the university testing service and utilize the Kellogg Biological Station with its small nature center geared to environmental teaching. About eight NREE courses are offered each term at MSU's five extension centers located throughout the state. A series of free "skill nights" (e.g., a session on running an Energy Resources Development Association game) open to all Michigan State students provides on-the-job training for students in the program. An established center handles evaluation and dissemination of environmental education materials.

According to the most recent MSU catalogue, the Department of Fisheries and Wildlife offers M.S. and Ph.D. degrees with areas of study in environmental conservation education, fish management, fishery biology, game management, limnology, pollution biology, and wildlife ecology. Emphasis is placed upon broad fundamental training in biological science and specialized training in one of these areas to prepare candidates for administration, research, management, teaching, or extension activities.

PROGRAM REQUIREMENTS

Undergraduate majors in Natural Resources and Environmental Education must complete 180 quarter hours. Most students (99 percent) elect to obtain teacher certification by completing thirty credit hours in required education courses and an appropriate teaching minor; but they may alternatively receive a non-certification degree which includes courses in natural resources, natural science, social science, and an additional fifteen credits oriented toward career goals.

Admission to the Fisheries and Wildlife M.S. program requires prior completion of an undergraduate major in a biological science which includes elementary courses in chemistry, mathematics, and physics. Students lacking these courses may be admitted provisionally until such deficiencies are removed by collateral courses. Unless waived in a special case, all candidates must complete a research project and prepare an acceptable thesis. Applicants for a doctoral program should have completed at least the elementary science courses required of master's candidates. Additional background in mathematics, chemistry, botany, and zoology is desirable. A qualifying examination may be given during the first term of enrollment as part of the admission to candidacy.

CURRENT FACULTY, STUDENTS, GRADUATES

There are no faculty members per se in the Natural Resources and Environmental Education program; rather, courses are taught by staff members in the departments offering this major and in related departments on campus. Each of the four sponsoring units--Fisheries and Wildlife, Forestry, Parks and Recreation Resources, and Resource Development--appoints a faculty coordinator for the NREE program within that department though no release time is officially provided for those duties.

Of the 155 undergraduate majors, 85 are women and 41 are in-state students. These figures do not include approximately 35 people who are returning for certification. There are 20 master's degree candidates and 6-10 doctoral students in Environmental Conservation Education and 40 percent of these are women. Approximately 50 B.S. diplomas, 5 M.S. diplomas, and 2 Ph.D. diplomas are awarded annually; these numbers are relatively stable. Enrollment lists indicate few part-time students in these programs.

One-third of the undergraduates (30-40 percent) pursue the M.S. degree and with their broad baccalaureate preparation, they can enter a variety of graduate programs. Approximately 85 percent of the graduates enter educational programs, 10 percent are employed in government and the remainder take jobs in industry and consulting. Unfortunately, the number leaving the program currently exceeds the number of jobs available to them in environmental education, natural resources, and conservation. The MSU placement service is regarded as excellent by the NREE faculty though the task of finding employment for the fifth-largest education major in the university is difficult.

Standard financial aid programs are available at Michigan State. Roughly 80 percent of the graduate students hold research or teaching assistantships.

PROGRAM PROJECTIONS

Though faculty and staff increases are needed, they are difficult to project. The NREE and related graduate programs should expand linearly over the next few years with administrative support at the federal level and public school support at the local and state levels; however, that increase will not be spectacular. If the Youth Conservation Corps is implemented extensively, the job potential for qualified personnel, such as those from these MSU programs, should expand. The program has experienced tremendous growth since its inception and encourages on-going evaluation and curriculum change.

COURSE DESCRIPTION*

Botany:

450 Ecology - Interrelationship of plants and environment. Factors which govern their distribution. (4 q.h.)

Education:

327L Methods of Teaching--Secondary Subject Areas: Natural Resources, Environmental Education, and Earth Science - no description (3 q.h.)

Entomology:

250 Pesticides, Their Alternatives and Environmental Quality - Impact of agricultural pesticides on man and his environment. Emphasizes the effect of chemicals on food production and combating diseases and ecological impalance. Presents pesticide alternatives for the future. (3 q.h.)

Fisheries and Wildlife:

305 Principles of Fisheries and Wildlife Management - Ecological concepts in management. Effects of regulations, refuges, stocking, species introduction, habitat manipulation, artificial feeding, genetic improvement, land use and control of predators, diseases and competitors on the production of fish and game. (3 q.h.)

374 Biological Oceanography - Biology of marine animals, with emphasis on physical, chemical and biological factors affecting their abundance and distribution. (3 q.h.)

376 Introductory Limnology - Lake and stream ecology including effects of natural and man-induced perturbations on freshwater ecosystems. (3 q.h.)

402 Environmental Conservation Education - Nature, distribution, and interrelationships of natural resources dictating the quality of man's environment. Principles of resource use, study of natural objects and techniques of teaching in and about the environment. (4 q.h.)

484 Outdoor Environmental Education - Using the outdoors as a teaching laboratory for ecological studies of plant and animal communities. Designed primarily for secondary teachers. (4 q.h.)

485 Environmental Conservation Program Design - Materials and methods for integrating environmental conservation into educational programs in schools, nature centers, youth groups, and communities. (3 q.h.)

821 Advanced Stream Ecology - Stream ecosystem energy budget models with emphasis on individual projects involving both laboratory and field experiments. Particular use will be made of artificial streams and locally abundant species of aquatic insects. (3 q.h.)

830 Environmental Requirements of Fish - Adaptations and responses of fish to environmental changes; research methods for evaluating environmental limitations and effects of pollutants on fish growth, reproduction and survival. Applications for developing water quality criteria. (3 q.h.)

874 Advanced Biological Limnology - Historical and current contributions to concepts of community structure, energy flow, and materials cycling in aquatic ecosystems. (3 q.h.)

875 Chemical Limnology - Application of analytical chemistry concepts and technologies to fundamental chemical mechanisms in natural and polluted water systems. Special consideration given to selected heterogeneous equilibria. (4 q.h.)

Forestry:

220 Plants and Their Environment - Fundamental ecological relationships between various climatic, edaphic, and biotic environmental factors of the ecosystem and plant response, including structure, function, and evaluation of species. (3 q.h.)

409 Forest Hydrology - Hydrologic cycle, with emphasis on soil, water, and ground water regimes; instrumentation and measurement of the various components. Effects of forest management on watersheds and water yields. (3 q.h.)

450 Natural Resource Administration - Concepts and methods of administering wildlife properties. The legal, economic, and social environment. Benefit-cost analysis of management changes. Unit organization, personnel management, and accounting. Presents a systems view of administration. (4 q.h.)

455 Natural Resource Economics - Basic economic and political principles and techniques that govern the production and consumption of forest land products, including basic forest valuation procedures. (4 q.h.)

Geography:

205 Oceanology--The Marine Environment and Man - Physical oceanography, including origin, hydrologic, chemical, geological properties; and environmental quality of the oceans. Man-sea interactions are emphasized including resource utilization and pollution. (3 q.h.)

282 Energy Resources of the Earth - World energy resources of petroleum, coal, and atomic fuel. Social, political, economic, and environmental problems of fuels. (3 q.h.)

Interdisciplinary Courses:

200 Resource Ecology and Man - Mechanisms by which the environment regulates man and his resources. Ecology as the unifying basis for resource management. Resource conservation policy and environmental quality. (3 q.h.)

201 Introduction to Environmental Systems - Basic systems concepts presented in a non-mathematical manner. Application to selected ecological topics, e.g., energy, water quality, food production, population dynamics. Interactive models provide opportunity for students to play decision-making role. (3 q.h.)

220 The Politics of Ecology - Political considerations fundamental to environmental issues. Theory, practice, and prescriptions for action are included. Economic, legal, and ethical factors influencing public policy decisions will be emphasized. (4 q.h.)

256 Energy Consumption and Environmental Quality - The role of energy as a fundamental pollutant will be discussed along with the availability of fossil energy sources. Limitations on the safe utilization of both fossil and nuclear energy will also be considered. (3 q.h.)

432 Introduction to Meteorology - A purview of atmospheric science including a study of the interactions between meteorology and living organisms. (3 q.h.)

Park and Recreation Resources:

302 Environmental Attitudes and Concepts - Beliefs and attitudes toward land by primitive man and ancient civilizations. Effects of Muir, Thoreau, and others on man/land relationships. Industrialism and environmental quality. Current environmental controversy. Field trip required. (3 q.h.)

351 Environmental Interpretation I: Principles - Philosophy, needs, types, and uses of information services in private, municipal, county, state, and federal park and recreation areas. The role of the park interpreter (naturalist). (3 q.h.)

451 Environmental Interpretation II: Methods and Devices - Methodology and equipment used in information transmission in natural, historic, and scenic areas. Site selection and development criteria for natural resource interpretation. (4 q.h.)

Resource Development:

202 Soils and Man's Environment - Use of soil-water resources in a technological society as it relates to environmental quality. Nature of pollution problems and their possible solutions. Food production and world population. (3 q.h.)

301 Conservation of Natural Resources - Development of conservation movement with broad treatment of basic natural resources (minerals, land, waters, forests, wildlife). Conservation practices and facilities, organizations, and agencies involved in their application. General introduction to the field. (3 q.h.)

420 Water Resource Development - Significance of water resources in modern society. Introduction to the needs of industry, agriculture and recreation. Concepts of development, use, and conservation are critically evaluated in terms of future needs. (4 q.h.)

821 Water Management Institutions - Major institutional structures and issues in water resource management. Emphasis on linkages between federal, state, and local management levels. (3 q.h.)

824 Watershed Management - Investigation of watersheds, emphasizing physical relationships of water to other resources. Survey of water problems, planning for water use and management practices including conservation and multiple use aspects. Field trips optional. (3 q.h.)

832 Natural Resource Law - Legal principles of natural resources administration. Focus on natural resource jurisdiction. Discussion of state and federal cases, statutes, and treaties. Constitutional and common law. Limitations on government power. (3 q.h.)

835 Water Resources Law - Legal principles affecting private rights in state and federal regulations of surface and ground waters. Emphasis on water quality controls. (3 q.h.)

836 Environmental Law I - Public and private legal controls and restrictions on resource use, including common law, nuisance and trespass, citizen suits, class actions, appeals from agencies, Administrative Procedure Act, National Environmental Policy Act. (3 q.h.)

837 Environmental Law II - Analysis of federal environmental laws (NEPA, WQIA, Clean Air Act). Form and content of Environmental Impact Statements and problem of agency discretion and judicial review. (3 q.h.)

838 Selected Topics in Environmental Law - Topics dealing with laws and legal issues in: toxic substances, technology assessment, transportation systems, wildlife and fisheries, air quality, land use. (3 q.h.)

Urban Planning:

471 Ecological Basis for Planning - Ecological principles, relationships, and interaction between natural and man-made elements of the environment; critical review of environmental planning projects at local, state, and national levels. (3 q.h.)

*Course Numbers: 100-299 Undergraduate;
300-499 Advanced Undergraduate;
500-699 Graduate-Professional;
800-899 Graduate;
900-999 Advanced Graduate.

INSTITUTION: MICHIGAN STATE UNIVERSITY

PROGRAM: System Science--Ecological Systems Study

DEPARTMENT: Electrical Engineering and Systems Science

DEGREE: Master of Science (M.S.)
Doctor of Philosophy (Ph.D.)

CONTACT: Dr. Erik D. Goodman
Department of Electrical Engineering and Systems Science
Michigan State University
East Lansing, Michigan 48824
(517) 353-9695

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The graduate program in Systems Science at Michigan State University is designed "to achieve two fundamental objectives: (1) to develop an understanding of the theoretical foundations of analysis, design and management relevant to a study area; and (2) to develop a capability for the application of these theoretical foundations to a specific area of interest." Students pursuing master's or doctoral degrees in Systems Science may interface their program of study with departments in the College of Engineering or elsewhere in the University; alternatively, systems work may serve as a minor for many specialized areas of exploration. The student may select a program concentration from among several established areas, including Ecological Systems.

Within the Ecological Systems Graduate Study Area, "many aspects of the fields of engineering, biology, and economics have been integrated and synthesized into what . . . is the beginning of what will eventually become a science of ecosystem design and management." The basic impetus of this specialized program is the realization that "we are literally faced with the task of designing and managing our technical means of production and consumption so that these man-made systems together with the natural environment as an extended ecosystem is physically stable, ecologically safe and socially and economically viable." Students design individual interdisciplinary programs of study according to their own interests and backgrounds in response to this basic social challenge. Incorporated into their plan of study is an application-oriented project course forcing them to synthesize the theoretical with the real.

A number of facilities at Michigan State lend support to the Ecological Systems faculty and students. The Pesticide Research Center with its analytical laboratory permits "basic research into pesticides and pest control." The W.K. Kellogg Biological Station, with its artificial streams and ponds, encourages independent research workers to utilize its facilities while "its staff research activities focus on ecological research, particularly freshwater studies." The Institute of Water Research "is concerned with the sponsoring and development of research in the field of water resources and the coordination of water-related activities on the campus." Computer facilities, including some remote terminals in the Electrical Engineering and Systems Science building, permit sophisticated, analytical research. MSU's Center for Environmental Quality promotes and coordinates campus-wide investigations related to energy and ecological management.

According to its bulletin, System Science's "research efforts . . . have made significant contributions in the on-line control of pest insects, modeling and simulation of freshwater lakes and woodland streams, and in the theoretical and applied analysis of material, energy and monetary flows in man-made and natural ecosystems as required in assessing technology and land-use alternatives for the future." Comparable research continues in the areas of pest management, freshwater lake systems, control of woodland streams, and land-use alternatives "with particular reference to energy and resource conservation, environmental quality, and long-term ecological stability." Research funding totals $1,000,000 with the National Science Foundation and Environmental Protection Agency providing substantial amounts and less, though important, support coming from the National Institute of Health.

PROGRAM REQUIREMENTS

As a rule, undergraduate degrees in engineering, mathematics, physics, or any field of the social or biological sciences demanding an equivalent level of mathematical proficiency will provide the necessary background for the M.S. degree. The same policy holds for those students with M.S. diplomas who enter the program as doctoral candidates.

The master's degree typically requires forty-five quarter hours and may be earned with or without a thesis. If one chooses the thesis option, from eight to twelve credits will be applied toward the thesis. The student, with the assistance of a faculty advisor, formulates an individualized plan of study. Doctoral candidates generally must complete approximately fifty quarter hours beyond the master's degree and a thesis based on original work. Courses "are prescribed by a major professor and a guidance committee to insure that the students will have a comprehensive knowledge of a major field and related subjects." Graduate coursework usually entails hours in basic systems, biology, ecology, resource development and management, and fisheries and wildlife.

CURRENT FACULTY, STUDENTS, GRADUATES

Fourteen faculty members primarily responsible for the Ecological Systems program have lines in the Departments of Agricultural Economics, Agricultural Engineering, Developmental Economics, Electrical Engineering and Systems Science, Entomology, and Zoology. Other faculty have students studying in this area but do not have direct responsibilities for the program, and some even enroll in Systems Science courses to upgrade and enrich their own training.

Currently, there are 4 M.S. and 2 Ph.D. candidates in the program and 9 Ph.D. students outside the department with concentration in Ecological Systems. Statistics on annual graduates indicate that 3-4 master's degrees and 3-4 doctoral degrees are conferred yearly--numbers that are stable or growing. The program could use more engineering students, but aid is becoming limited.

Financial aid to graduate students takes several forms--teaching or research assistantships ($3800-4100/9 mo.); traineeships; and fellowships from the university, corporations, and various government offices. Out-of-state tuition fees are waived for those on half-time assistantships.

Students experience no difficulty in finding employment and are placed in government, industry, consulting, and teaching positions. Job descriptions include formulating environmental impact statements, developing long-range planning models for agencies such as the Department of Natural Resources and the U.S. Forest Service and for utilities and industry, and conducting basic and applied research in conjunction with university teaching responsibilities.

PROGRAM PROJECTIONS

Environmental programs are growing at a rapid rate with keen student interest in them. At Michigan State, over half the majors in zoology and in fisheries and wildlife take a two-course sequence in biological, ecological, and systems concepts and ecosystem analysis, design, and management. Funding is needed to support additional graduate students and faculty, the latter resulting in an expanded curriculum. The Ecological Systems program enjoys a very positive, exciting image on the MSU campus, and other departments in East Lansing are trying to get "aboard" it.

COURSE DESCRIPTION

Systems Science:

404 Biological and Ecological Concepts for Engineers and Mathematicians- Biological and ecological concepts important to formal analysis of living systems, vital properties, processes, and limitations; population dynamics, selection, competition, and predation; ecological community structure and function; industrialized ecosystem. (3 q.h.)

410 Systems Methodology - The systems approach in multidisciplinary large scale problem solving. The development of useful systems analysis tools; systems design; feasibility study; computer simulation for feasibility evaluation. (3 q.h.).

411 Systems Project - Completion of a systems study initiated in 410. The project may involve the design of hardware, simulation of a solution to an interdisciplinary problem, or development of a solution concept. (2 q.h.)

442 Systems Concepts for Biologists - Basic concepts of systems science important to formal analysis and control of biological communities, with emphasis on modeling and on analysis of behavior through numerical solutions. (3 q.h.)

811 System Methodology and Simulation - Problem definition, design of abstract models for system design and control, simulation of systems described by differential and difference equations, generation of random variables, simulation of discrete object stochastic systems, simulation languages, applications to physical, economic, and social systems. (3 q.h.)

813 System Project - Individual or team application of simulation methods, to system design and/or management. (3 q.h.)

814 Advanced System Methodology and Simulation - Simulation of a class of time-varying distributed parameter processes; organization and design of large simulation models; optimization and parameter estimation in large simulation models; applications to economic, social and biological systems; other topics of current interest. (3 q.h.)

843 Ecosystem Analysis, Design, and Management - Groups of students from biological and non-biological disciplines will synthesize and analyze models of selected biological sytems. Projects should yield information relevant to solution of contemporary ecological problems. (3 q.h.)

INSTITUTION: MOREHEAD STATE UNIVERSITY (MSU)

PROGRAM: Environmental Studies

DEPARTMENT: Center for Environmental Studies

DEGREE: Bachelor of Science (B.S.), Bachelor of Arts (A.B.)

CONTACT: Dr. Jerry F. Howell, Jr. Director
Center for Environmental Studies
Morehead State University
Morehead, Kentucky 40351
(606) 783-3328

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

This multidisciplinary program began as a minor in 1973, and became a major in 1974. The program is structured to allow students a choice among four multidisciplinary options to satisfy the major requirements; these are: the Ecology Option, the Geology Option, the Chemistry and Physics Option (all three leading to the B. S. degree), and the Social Sciences and Economics Option (leading to the A.B. degree). In addition to the Environmental Studies major the original minor is still offered.

Graduates of this program have qualifications for a wide variety of occupations, such as environmental education (Earth Science and Biology), teachers, water quality inspectors, strip mine reclamation inspectors, water treatment plant operators, air pollution monitors, air pollution equipment testers, environmental consultants, planners, environmental sanitarians, water and wastewater technicians, recreation specialists, environmental geologists, and many others.

Each of the four options involves major course work involving four to six MSU departments. The Departments of Biology, Chemistry, Geoscience, Mathematics, Physics, Geography, Economics, and Political Science provide primary support for these options.

The location of MSU provides a natural environmental laboratory. The university maintains its own lake and has access to Cave Run Reservoir, including the second largest fish hatchery in the United States. MSU also operates the Crosthwaite Outdoor Educational and Research Center on Cave Run Lake. Nearby mountain streams and valleys provide excellent opportunities for geologic and faunal studies. Environmental problem areas can be examined via field trips to nearby sites. MSU is within a few hours' drive of the largest coal producing counties in the U.S., in southeastern Kentucky.

An important facet of the program is its co-op program. Eight students have co-oped with organizations such as the Union College Environmental Education Center, the Area Health Education System, the Gateway Area Development District, and others, and have received financial assistance in this way.

Several environmental conferences and workshops are held on campus each year. A sampling of conferences which have been conducted includes environmental impact statement writing, noise pollution. the energy crisis, and world hunger. A three-credit-hour workshop in environmental biology, stressing environmental education is offered to in-service teachers at an off-campus location.

PROGRAM REQUIREMENTS

For entrance to MSU, the applicant must have either a diploma from an accredited high school or the equivalent. Out-of-state people may be asked to submit standardized test scores (i.e., ACT or SAT). Students whose academic performance has not been satisfactory might be admitted conditionally beginning in the summer quarter and contingent upon the completion of remedial work. It is advantageous for the enrollee to have a high school background in mathematics and science.

Every student in this major must take the environmental core of nineteen semester hours of specified course work. The core curriculum is taken from the Departments of Science, Biology, Geoscience, Economics, Political Science, and Geography, and provides the necessary broad base for continued study. Once the student has decided which of the four major options she/he will pursue, it becomes necessary to select an allied minor from any one of several topics available at MSU. The minor consists of twenty-one approved semester hours.

The Ecology option requires thirty-five semester credits of specified courses from the Departments of Biology, Chemistry, Geoscience, and Mathematics. Thirty-six semester credits are necessary for the Geology option. The Departments of Geoscience, Science, Mathematics, Biology, Chemistry, and Physics supply courses for geology students. The Departments of Geography, Economics, Political Science, Social Science, Geoscience, and Biology provide the thirty-five semester credits which compose the Social Science and Economics option. Chemistry and Physics is the final choice for a major option and it requires thirty-eight designated credits from the Departments of Chemistry, Physics, Geoscience, Mathematics, and Biology.

Students who wish to major in a subject area other than Environmental Studies may take an Environmental Studies minor, which is an excellent adjunct to several majors on campus. This minor requires sixteen semester credits of rigidly prescribed courses in addition to five or six credits (two courses) which are selected from seven approved courses.

MSU requires 128 semester hours for graduation. The difference between the number of credits required for major requirement fulfillment and those for graduation are designed to be taken in free electives.

CURRENT FACULTY, STUDENTS, GRADUATES

In addition to faculty from the eight disciplines represented in the major requirements, there are some fifteen different faculty members from eleven departments who regularly teach in the program, and there is one full-time person who coordinates the major, which is the reason for this being designated a center rather than a department. The director's responsibilities include curriculum design, instruction, program coordination, advising each of the 101 full- and part-time students, fund solicitation, and recruitment of new students. Clearly, there is a need for additional faculty and at this time MSU is seeking a person with water and air testing capabilities for a direct assignment to Environmental Studies.

The environmental studies minor began with ten students and during the next year enrollment increased to thirty-seven, but dropped to twenty in the fall of 1974 as a function of transfers to the major once it became operative. Since then the number has become relatively stable at around twenty-two.

Since its inception, the major has experienced rapid growth by an average rate of twenty additional students per year; it began with twenty-three in 1974 and during the academic year 1977-1978 eighty-three people were enrolled. It is significant that this rate of growth has occurred while the university at large has had a stable enrollment level.

Of thirty-five graduates to date, thirty-one, or 89 percent have found environmentally related employment. Four of this year's graduates found employment in state agencies, one as a strip mine inspector, two as water quality control specialists, and one as an environmental sanitarian with a local health department. Five are working with private industry in air pollution control, in water and wastewater engineering, and in environmental geology. Two are secondary teachers, two are working for environmental consulting companies and one is a recreation specialist with the Boy Scouts of America. A small percentage of the graduates have gone on for further training.

PROGRAM PROJECTIONS

Program officials report the desire to expand the enrollment of this program and are effecting this growth through a substantial recruitment effort. Because of the benefits derived from actual work experience, the co-op program will be recommended to students and will be expanded. This, of course, will require placement commitments from industries which wish to become involved.

COURSE DESCRIPTION

Core Courses:

Science 355 Population, Resources, and Environment - Human ecology with special emphasis on relationships between man, his resources, and his environment. (3 s.h.)

Biology 356 Environmental Biology - Basic ecological principles and population and community ecology are discussed as they apply to current environmental problems. (3 s.h.)

Geoscience 376 Environmental Geology - Man's relationship to the geological environment. Geological hazards and hostile environments; mineral resources and the environment; urban geology. (3 s.h.)

Science 471 Seminar - An introduction to research and literature in the sciences. (1 s.h.)

Economics 501 Environmental Economics - Analysis of the economic causes of environmental degradation and exploration of alternative economic policies to reduce this problem. (3 s.h.)

Political Science 500 Pressure Groups and Politics - Theory of interest groups; role of interest groups in political process; group ideology; techniques of political propaganda. (3 s.h.)

Geography 505 Conservation of Natural Resources - Natural resources basic to human welfare; emphasis on lands, water, minerals, forests, and wildlife, including their interrelationships. (3 s.h.)

Option Courses:

Biology 356 Environmental Biology - Basic ecological principles and population and community ecology as they apply to current environmental problems. (3 s.h.)

Biology 357 Environmental Testing Methods - Study of methods used in determining water quality and air and noise pollution levels. Includes techniques of animal and plant population estimation. (2 s.h.)

Biology 510 Limnology - Characteristics of fresh water conditions including chemical and physical effects, seasonal changes, thermocline development, and pressure in the ecology of aquatic forms. (3 s.h.)

Biology 561 Ecology - Energy flow, biochemical cycles, limiting factors, and ecological regulators at the population, community, and ecosystem levels. (3 s.h.)

Geoscience 240 Oceans - Broad general background in the biological, chemical, physical, and geological aspects of oceans and ocean basins; various types of pollution and future economic potentials in the oceans. (3 s.h.)

Geography 390 Weather and Climate - Introduction to the physical elements of weather and climate; classifications of types and their distribution, with reference to the effects on the earth's physical and cultural landscapes. (3 s.h.)

Economics 541 Public Finance - Public expenditures; public revenue; taxation; public credit; financial administration of government. (3 s.h.)

Economics 201 Principles of Economics I - Theories of income, employment, monetary policy, fiscal policy, price level and economic growth. (3 s.h.)

Political Science 540 Public Administration - Historical evolution; theory of organization and administration; personnel, financial, and legal aspects of public administration. (3 s.h.)

Physics 350 Nuclear Science - Interdisciplinary course in nuclear science for students in pre-medicine, environmental studies, physics, chemistry, geology, pre-dentistry, and pre-veterinary medicine. (4 s.h.)

Physics 361 Fundamentals of Electronics - Laboratory oriented electronic principles, components, basic circuits, servo systems, amplifiers, feedback control and digital circuits; transister and vacuum tube devices. (3 s.h.)

INSTITUTION: MUSKINGUM AREA TECHNICAL COLLEGE (MATC)

PROGRAM: Natural Resources Conservation Technology

DEPARTMENT: Division of Engineering and Science

DEGREE: Associate of Applied Science (A.A.S.)

CONTACT: Mr. Charles M. Woolf, Division Chairman
Division of Engineering and Science
Muskingum Area Technical College
1555 Newark Road
Zanesville, Ohio 43701
(614) 454-2501

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

Students enrolled in the Natural Resources Conservation program at Muskingum Area Technical College receive an introductory background in natural resource management. They learn practical applications and techniques in forestry, wildlife, recreation, agricultural conservation, and environmental engineering. The program is unique in that the student who is interested in outside work, natural resources, and environmental protection can select the area which holds the greatest interest for him/her after being exposed to a variety of employment opportunities and job specializations.

The broad NRC curriculum has spawned workshops on such diverse topics as strip mining, fireplaces, farm pond construction, and small wood-lot management. Numerous federal, state, and local landholdings provide excellent outdoor facilities for student training; the faculty do note, however, the need for a land laboratory to facilitate the management and implementation of techniques seen during on-site visits to these public properties. Students complete a credit-granting internship during the summer session in work related to their particular curricular interests.

PROGRAM REQUIREMENTS

To obtain the Associate of Applied Science in Natural Resources Conservation Technology, the student must complete 108 quarter hours in basic sciences, mathematics, communications, social sciences, and, of course, natural resources conservation. Admission to MATC requires a high school diploma or its equivalent, and college prep math is recommended for the Engineering and Science Technologies which include the NRC program.

CURRENT FACULTY, STUDENTS, GRADUATES

The Natural Resources Conservation program, begun in 1969, has three full-time faculty members serving 55 first-year students and 26 second-year students. Standard financial assistance programs provide educational funding for MATC students (e.g., Basic Educational Opportunity Grants, Ohio Instructional Grants, college work-study, national and Ohio student loan programs). Approximately one-third of the student body at Muskingum Area Technical College is on some form of student aid.

Of the recent NRC graduates (average of 30 annually), roughly 70 percent are employed in their technological field of training, 17 percent seek further schooling, and the remainder are either employed outside the field or no follow-up information is currently available to them. Employment opportunities include: National Park Service, Agricultural Stabilization and Conservation Service, U.S. Forestry Service, Soil Conservation Service, State Department of Natural Resources, metropolitan park systems, pulp and paper industries, surface mining companies, landscaping firms, private campgrounds, surveying and environmental engineering, and nursery firms. A job placement officer assigned to the NRC program, the program's advisory committee, and the student internships all contribute to the placement of program graduates. Faculty note that the job market is unfortunately becoming very competitive due to the number of graduates nationwide.

PROGRAM PROJECTIONS

As leisure time increases for Americans, the need for trained technicians in parks and recreational centers as nature interpreters and even enforcement personnel should also grow. Faculty anticipate curricular revisions will need to be implemented to reflect this shift in employment opportunities. In addition to land-laboratory facilities, the need exists for quality curriculum materials in wildlife management according to NRC staff members. They argue that students must be trained using up-to-date facilities and texts if they are to meet the environmental demands placed on them by today's job market. Likewise, employers must be educated to recognize the capabilities of the two-year graduate as a competent, skilled technician.

COURSE DESCRIPTION*

BIOL 141 Field Zoology and Ecology - A study of the animals common to this area, stressing identification and the environmental aspects which affect their distribution. The basic principles of ecology are covered with emphasis on the interrelationships between an animal and his physical and biological surroundings. (3 q.h.)

NRC 100 Soil Science - A study of the formation, classification, and productive capability of soils in Ohio. Problems concerning fertility, texture, structure, drainage, and handling properties of these soils will be discussed. (3 q.h.)

ENV 135 Earth Science - A study of the physical principles guiding the earth's development, including basic geology, weathering, and land forms; the method of locating points on the earth and principles of mapping; principles of meteorology; interactions of abiotic and biotic components of the environment. (3 q.h.)

NRC 151 Techniques of Environmental Testing - A summary course dealing with tests and measurements used in air and water quality evaluation, physical, and chemical methods for examination of air, water, and wastewater. (3 q.h.)

BIOL 151 Field Botany and Ecology - A study of the structure and life processes of plants, the classification and identification of plants, and the basic principles of plant ecology stressing the environmental affects on the morphology, physiology, and distribution of plants. (3 q.h.)

NRC 261 Fisheries Management - Freshwater fishes are studies in terms of their taxonomy, morphology, life history, and ecology. Aquatic habitat evaluation is combined with management practices for lakes, ponds, and stream systems. Population studies, age, growth, food habits, and stocking techniques are incorporated into sound ecological practices. (3 q.h.)

NS 200 Internship - Supervised work experience required for environmental sciences students. Includes student applying for job in related area, on-the-job supervision, scheduled visits by coordinators, and periodic evaluations. (7 q.h.)

NS 299 Seminar - Course taken in conjunction with Internship. Includes discussion of students' intern experiences, principles of employment practices, and improvement of employee traits. (3 q.h.)

NRC 222 Landscape and Turf Management - Training in the use of landscaping equipment and in the production, handling, and maintenance of horticultural species of the northern United States; with consideration of species selection, morphological characteristics, environmental adaptability, pest problems, aesthetic significance of plant materials with special emphasis given to turf establishment and management. (3 q.h.)

NRC 212 Wildlife Habitat Management - Habitat evaluation and manipulation techniques are studies and put into practice in the field. Cover mapping, vegetative analysis, release cutting, and controlled burning are just some of the operations used in the ecological assessment and management of successional stages for game and non-game species. (3 q.h.)

NRC 213 Wildlife Population Management - The sampling and analysis of wildlife populations are emphasized. Census techniques, mark-recapture methods, and removal methods are used to assess population numbers. Age and growth studies, survivorship curves, condition, sexing, and autopsy techniques for birds and mammals including vertebrate pest species are covered. (3 q.h.)

NRC 225 Stripmine Reclamation - Surface mining and stripmining operations in the United States with major emphasis on the coal stripmining process in southeastern Ohio. The methods and procedures for mine operation and reclamation under the new Ohio and "pending" federal Reclamation Laws to return to usable and desirable land use patterns with minimal detrimental effects to the environment. (3 q.h.)

*courses are listed in the sequence taken by the student

INSTITUTION: NORTHLAND COLLEGE

PROGRAM: Environmental Studies
DEPARTMENT: Interdisciplinary
DEGREE: Bachelor of Arts (B.A.)

CONTACT: Dr. Robert K. Maxwell
1411 Ellis Avenue
Northland College
Ashland, Wisconsin 54806
(715) 682-4531

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The Environmental Studies major was first offered in 1971. Three different core programs, 14 to 16 units each, lead to a series of applied areas which require an additional 6 to 11 units. Programs are interdisciplinary in nature. Thirty-five units are required for a bachelor's degree.

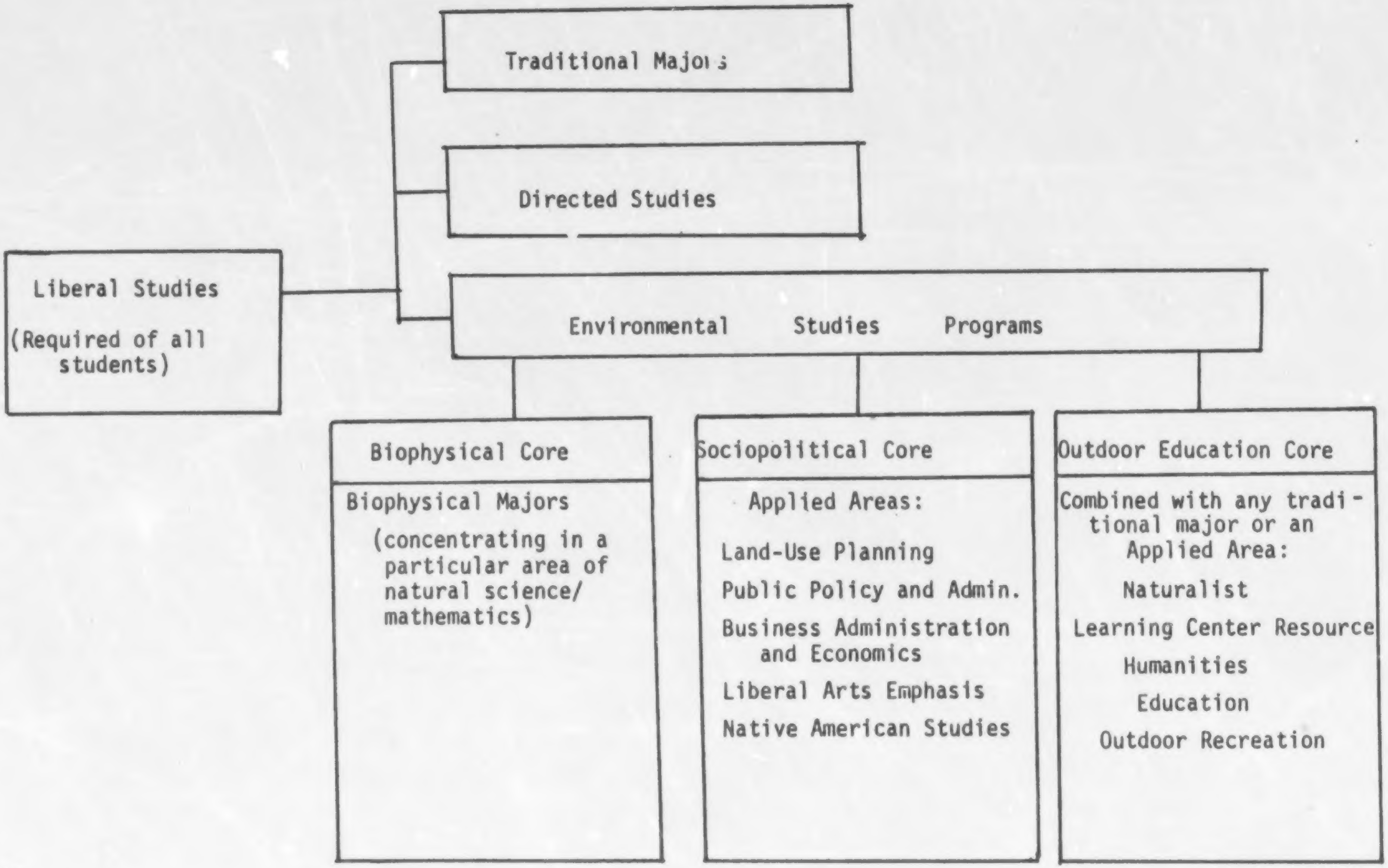
Credits are offered on a unit system, one unit equalling 3.5 semester credits or 5.25 quarter credits. The fall and winter terms are 13 weeks in length. Spring term (April-May and one month long) provides an opportunity for travel-study or an independent study option. A third possibility is to participate in the spring term consortium. This is a group of nine colleges located in Michigan, Ohio, Kentucky, Indiana, Florida, Iowa, Missouri and Wisconsin that permits students to register at any of the campuses for courses being offered there during the spring term.

PROGRAM REQUIREMENTS

Admission is dependent on SAT, ACT or other acceptable admission test scores, high school record, and recommendation of secondary school officials.

Seven Liberal Studies courses are required of all students regardless of their majors. Two are of particular concern for this study. The freshman communication courses are entitled "Man in Nature" and have the environment as the common thread for the development of reading, speaking and writing skills. "Environment and Man" is a study of the scientific aspects of man's relationship to his environment.

A schematic drawing of the offerings at Northland follows:


Traditional Majors
Directed Studies
Liberal Studies
(Required of all students)
Environmental Studies Programs
Biophysical Core
Biophysical Majors
(concentrating in a particular area of natural science/ mathematics)
Sociopolitical Core
Applied Areas:
Land-Use Planning
Public Policy and Admin.
Business Administration and Economics
Liberal Arts Emphasis
Native American Studies
Outdoor Education Core
Combined with any traditional major or an Applied Area:
Naturalist
Learning Center Resource
Humanities
Education
Outdoor Recreation

CURRENT FACULTY, STUDENTS, GRADUATES

One-third of the faculty members (15) are directly involved in the Environmental Studies program.

Seventy-five percent of the student body received financial assistance from Northland, private institutions, state or federal grant programs.

The College also administers a federal grant ($34,000 in 1977-78) for cooperative education. Any student can participate in this opportunity to prepare for careers in business, industry, government and community organization through field experiences. Credit can be arranged, the experience can be full or part-time and there may or may not be pay involved.

ADDITIONAL INFORMATION

In June, 1977, Northland received a three-year grant from the National Endowment for the Humanities for $180,000 to develop, offer and refine four courses in integrating the Humanities with Environmental and Native American Studies program. Five senior seminars will also be developed in cooperation with the Lake Superior Association of Colleges and Universities. Yearly conferences will be held to make the public aware of the findings of the seminars. This will be in cooperation with the Sigurd Olson Institute.

The Institute, founded in 1972, works with the College's environmental program, and, in addition, collects and disseminates information pertaining to environmental matters as a community outreach arm of the college to the surrounding communities. It operates under funds partly from the college but mostly from grants, gifts, federal monies (e.g., Office of Environmental Education). The basic budget has averaged $100,000 per year and workshops, seminars, etc., are handled on a regular basis.

The Institute's biannual journal, Northland, is in its fifth year of publication. The Johnson Lecture series is intended to present a spectrum of environmental views, especially those areas of concern to North Country people.

COURSE DESCRIPTION

(The following list are examples of interdisciplinary courses that have been developed and which relate to the environment.)

Biology 281 Spring Transition - The use of field biological and geological methods and outdoor skills to understand the natural processes of spring in ecosystems across the Lake Superior basin to the headwaters of the Mississippi. (1 unit)

Chemistry 300 Technology Assessment - An interdisciplinary course in which students do projects which assess the probable social, political, environmental, economic, technical, and other consequences of a new technological development. (1 unit)

Economics 210 Evironmental Economics - Study of external diseconomies. Pollution and congestion as a function of economic maturity. Social costs and benefits versus private costs and benefits. Theories and measurement of economic costs of air, water, urban, and industrial pollution. Appraisal of current federal and state antipollution legislation. (1 unit)

English/History 243 The Frontier - History, politics and literature relative to the environmental experience of the American frontier. (1 unit)

Geography 372 Land and Water-Use Planning - The philosophy and process of natural resource planning on a regional level; beginning with the land base, and following with the social aspects of land ownership and conflicts, and government planning and implementation. (1 unit)

History 240 Man, Nature and History - Traces man's perceptions of nature and man's impact on the landscape over the course of Western history. This course covers the history of the American conservation movement and the development of the environmental crisis. (1 unit)

History 241 Environment and Man in American History - A survey course which considers the historical roots of the environmental problems confronting American society and the attempts Americans have made to solve these problems. The course will consider some of the following topics: attitudes toward the wilderness; land use in America; the early conservation movements; associations involved in the movement during the 20th century; recent legislation designed to reduce environmentally related problems. (1 unit)

Humanities 300 North Country Values - An examination of the Lake Superior environment in terms of history, literature, and ethnic background, and value-laden environmental issues. (1 unit)

Liberal Studies 111/112 Man and Nature in Literature - Practice in reading, speaking, and writing skills through a study of essays dealing with environmental issues; followed by a study of the short story, novel, drama, and poetry treating the close relationship between man and the physical environment. (1 unit)

Liberal Studies 123 Environment and Man - Selected studies from the scientific aspects of man's relationship to his environment. Topics will involve the biological and physical sciences with particular emphasis on current environmental problems. (1 unit)

Native American Studies 300 Ethnobiology - The course will combine scientific study with traditional Native American philosophy and ingenuity in reference to the natural environment. Students will learn how the Indian uses natural surroundings for essentials of life. The course will involve students in field work and projects. (1 unit)

Outdoor Education 281 Concept of Wilderness - Develop an ecological philosophy and land ethic by studying the structure and function of a diverse set of wilderness systems: Big Horn Mountains, the Dakota Badlands, and the Boundary Waters Canoe Country. (1 unit)

Philosophy 280 Social Philosophy - The environmental crisis raises the ultimate threat of death, not only of man, but of the biosphere as well. It also raises profound questions concerning the meaning of life. This course focuses on death from a variety of perspectives - art, psychology, biology, as well as philosophy and religion. (1 unit)

Political Science 313 Politics of the Energy Crisis - An examination of the political causes and consequences of the energy crisis, with emphasis on the types of responses from the American political system to a crisis situation. This course also analyzes the international political effects of the energy crisis, in terms of the relative positions of the major powers and the energy producing nations. The responses of various international political organizations will be investigated. (1 unit)

Political Science 371 Environmentalism in the Public Arena - Voluntary group dynamics and political interest group techniques as illustrated by environmental organizations and their campaigns. (1 unit)

Political Science 420 Seminar in Law: Environmental Law - A seminar covering the following topics: federal and state legislation and adminstrative regulations affecting the environment, the law of the "taking" of property without due process of law through environmental degradation, case law governing environmental standards including various forms of pollution, and legislative and case law governing environmental management and impact statements. (1 unit)

Sociology 240 Man and Nature in Cross-Cultural Perspectives - A consideration of the relationship of man to the physical environment in non-Western, non-industrial societies; the interaction between man and nature as reflected in social structures and religious conceptions. (1 unit)

INSTITUTION: OHIO STATE UNIVERSITY

PROGRAM: Environmental Education

DEPARTMENT: Division of Environmental Education

DEGREE: Bachelor of Science in Natural Resources (B.S.)
Bachelor of Science in Education (B.S.)
Master of Science in Natural Resources (M.S.)
Doctor of Philosophy (interdepartmental) (Ph.D.)

CONTACT: Dr. Robert E. Roth, Division Chairman
Dr. Gordon E. Gatherum, Director, School of Natural Resources
The Ohio State University
124 W. 17th Street
Columbus, Ohio 43212
(614) 422-5589

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The division offers three program options to its undergraduates--environmental interpretation, environmental communications, and environmental education, which with dual enrollment in the College of Education grants teacher certification in elementary and secondary schools. Graduate students may pursue an M.S. degree in Natural Resources within the Environmental Education Division or construct an interdisciplinary Ph.D. program with major advisors in a sponsoring department(s) and from the Environmental Education faculty.

Undergraduates selecting the Environmental Interpretation option are trained to "create an awareness of man's place in the natural world" for visitors of parks, nature sanctuaries, historic areas, and museums. Interpretors utilize their knowledge of communications and the natural, physical, and social sciences to "bring a subject alive" on trails, guided hikes and tours, slide programs, exhibits, and interpretive centers. Those students opting for specialization in Environmental Communications enter a rapidly growing field as writers, photographers, and media and public relations practitioners. Coursework under this option may be taken in the Departments of Journalism, Communication, and Photography. If students choose the Environmental Education option, they may eventually work in the public schools, outdoor education programs, or vocational programs, or in industrial or government agency information and education services. Their program includes environmental management and methods courses.

The M.S. program allows the student great flexibility in designing a plan of study tailored to one's career objectives. Core courses in natural resources problems, programs, policies, and management provide a fundamental curriculum for graduate study at this level.

The Ph.D. program is similarly unstructured and interdisciplinary given that the School of Natural Resources and the Division of Environmental Education do not officially award such a degree. Students construct their own plans of study under the supervision of advisors from other departments and from the Division of Environmental Education and under the auspices of the Graduate School.

Internships at both the graduate and undergraduate levels are available in which students can simultaneously gain valuable job experience and college credit. These internships have been with the Ohio Department of Natural Resources, Ohio Environmental Protection Agency, U.S. Soil Conservation Service, Tennessee Vally Authority, National Park Service, U.S. Environmental Protection Agency, Conservation Foundation, and Antioch Outdoor Education Center.

Facilities available to students and staff include the Barneby Center for Environmental Studies and the Ohio Agricultural Research and Development Center in Wooster, Ohio. The Division maintains a close cooperation with the Ohio Department of Natural Resources and has access to much state land. Students also enjoy the environmental literature research and information services of the ERIC National Clearinghouse for Science, Mathematics, and Environmental Education located on the campus. (One faculty member is the Associate Director of ERIC; another is an ERIC research associate.)

Extension services involving environmental education are numerous but often under the auspices of or co-sponsored with the Ohio Extension Service. Recent workshops, seminars, and short-courses have dealt with remote sensing; rural and urban land-use; problem-solving in the development of local environmental programs; forest inventories; and metropolitan park use, services, and personnel. The division has recently received a three-year Environmental Protection Agency grant to assess print and non-print manpower training materials in water resources, water management, and pesticides using the criteria of scientific accuracy, compliance with EPA regulations, and educational usefulness. Ohio State University faculty are working to bring the EPA's IRIS (Instructional Resources Information System) into the ERIC (Educational Resources Information Center) system.

PROGRAM REQUIREMENTS

The B.S. degree in Natural Resources or Education requires 196 quarter hours. Students must take core courses in natural resources, ecology, plants, water, and soils (geology and economics) and coursework within their selected areas of specialization. Master's degree candidates should have an undergraduate degree in a natural resources field or relevant basic discipline or have significant employment experience in a natural resources management or related area and an undergraduate degree in any area. The thesis option requires 45 minimum hours, 15 of which may be thesis credit. The non-thesis option requires 55 minimum hours and two papers, at least one of which represents an individual study. The student-designed program of specialization for the M.S. degree must exhibit "coherence and educational or communications applicability."

CURRENT FACULTY, STUDENTS, GRADUATES

Five full-time faculty in the Division serve 135 undergraduate majors and 48 graduate students (38 M.S., 2 Ph.D.) in the environmental education area. Nearly half of the graduate students are part-time due to full-time employment as teachers. Numbers of graduates annually are relatively stable (40 B.S., 10 M.S., and 1 Ph.D.). Students at the undergraduate level may qualify for scholarships, research grants within the honors program, or work-study. Graduate students often receive fellowships or associateships (administrative, teaching, and research). Job placement records indicate equal percentages of graduates take jobs in the public and private sectors. The internship program facilitates the job-market entry for many students.

PROGRAM PROJECTIONS

The Ohio Legislature has appropriated $13.5 million for a new building to house the Departments of Agronomy and Plant Pathology and the School of Natural Resources which should tremendously improve research laboratories and facilities for the Environmental Education program. Faculty members with expertise in resource development and environmental communication are needed to maintain a balance in the curriculum offerings. Even with increases in enrollment in this Division, the program has yet to reach a critical mass. A level of hard-money funding for faculty would enable the Division to establish a financial base for seeking grants.

COURSE DESCRIPTION (Selected)

Agronomy: 330 Soil in Man's Environment - The physical, chemical and microbiological properties of soils and their effects on the total environment, the role of soil in construction and waste disposal in agriculture and horticulture. (U 5 q.h.)

Botany: 620 Community Ecology and Ecosystems - A qualitative and descriptive approach to the establishment, development, succession, and dynamics of plant communities and their interrelations with historic, climatic, soil, and biotic factors. (U G 5 q.h.)

Entomology: 200 General Entomology - The biology of insects, form, function, classification, behavior, and ecological relations, including effect on man. (Lecture U 3 q.h. - Laboratory U 2 q.h.)

Geography: 530 Conservation of Natural Resources - Philosophy of resource use; appraisal of resource base; costs of resource development and conservation; resource perception, utilization and alternatives. (U G 4 q.h.)

Geology and Mineralogy: 204 Water Resources - Occurrence, movement and behavior of water in the hydrologic cycle with reference to scientific and technological problems relating to water-resources development and conservation. (U 5 q.h.)

Natural Resources: 201 Introduction to Conservation of Natural Resources - Nature and scope of environmental problems; technical and socio-economic aspects of the solution of such problems. (U 3 q.h.)

310 Natural Resources Interpretation/Education Program Development in the Urban Setting - Field experiences in planning and implementing natural resources interpretation/education programs/projects in an urban community. (U 3 q.h.)

515 Interpretive Centers - A detailed examination of visitor centers, nature centers and other interpretive centers; considerations include their funciton, visitorship and integration with the natural environment. (U 5 q.h.)

540 Principles of Park and Recreation Management - Structure and behavior of the physical, institutional, and economic dimensions of public outdoor recreation management at the state and national levels of government. (U G 5 q.h.)

571 Resident Outdoor Education Participation - Participation as assistant teachers in resident outdoor education sessions conducted at Barneby Center for Environmental Studies plus presessions, postsessions, and performance evaluation. (U G 2-5 q.h.)

600 Natural Resources Problems, Programs, and Policies - Analytical study of contemporary and future problems of natural resources conservation and programs and policies related to their solution. (U G 4 q.h.)

602 Watershed Resource Evaluation - In-depth field study and evaluation of natural resource parameters and management interactions within a small watershed. (U G 5 q.h.)

622 Field Laboratory in Renewable Natural Resources Management - Field experience in identifying and solving problems in the management of renewable natural resources; work in a variety of habitats using appropriate tools and techniques. (U G 15)

692 Workshop in Environmental Education - Problems of instruction in environmental education with consideration of both traditional approaches and current developments in content and methodology. (U G 3 q.h.)

701 Simulation in Natural Resources Management - Interactive aspects of natural resources management, with particular respect to pollution problems, primarily through group involvement in a computer simulation. (U G 4 q.h.)

U = undergraduate G = graduate

INSTITUTION: PRINCETON UNIVERSITY

PROGRAM: Environmental Science and Policy (Environmental Studies)

DEPARTMENT: Center for Environmental Studies (multidisciplinary)

DEGREE: no degrees granted by Center; degrees granted through departments

CONTACT:
Selma L. Lapedes, Assistant to the Director
The Center for Environmental Studies
The Engineering Quadrangle
Princeton University
Princeton, New Jersey 08540
(609) 542-3000

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The Center for Environmental Studies at Princeton University was established in 1970 to span the gap between public affairs and technology which could not be contained within the traditional department structure. A multidisciplinary group of faculty research staff and students, it is administratively and physically housed in the School of Engineering and Applied Science.

The Department of Geological and Geophysical Sciences grants the Bachelor of Arts degree and offers an interdisciplinary program in Environmental Sciences. The School of Engineering and Applied Science grants the Bachelor of Science degree in Engineering and offers a Topical Program in Environmental Studies. The Center for Environmental Studies assists both of these departments and others in providing opportunities for undergraduates to conduct independent work during their junior and senior years (required of all Princeton undergraduates) at the Center. Students become involved in the activities of the Center by undertaking independent work related to a multidisciplinary study in the center, through the research of their faculty advisors, or by participation in selected seminars, conferences, or workshops related to their programs. Thus, the Center complements the traditional academic departments by providing environmental studies in the form of research and conferences to students.

The Center's multidisciplinary academic group in technology and public policy has three major research fields: regional land-use policy which covers environmental problems and their relation to associated energy concerns; technological aspects of energy conservation; and nuclear energy policy and alternatives. The Center provides facilities for research, conferences, workshops, and seminars in which academics and professionals participate. The Center's members and faculty associates are active in the teaching programs of various departments and in special seminars and other activities.

PROGRAM REQUIREMENTS

There are no special requirements for Princeton undergraduates and graduate students to participate in the Center's activities, other than the requirements of the departments through which the students are affiliated.

The Center for Environmental Studies is not a degree-granting unit of the university. Students earn degrees by completing the requirements of the department in which they are enrolled. The Center provides a service to students to enable them to complete their required independent work projects.

The regular program to complete the requirements for the Bachelor of Arts degree includes completion of thirty courses and independent study may be begun during the sophomore year in lieu of a course. The School of Engineering and Applied Science requires completion of at least thirty-six courses in order to earn the Bachelor of Science degree in Engineering. Included are an independent work requirement and completion of at least seven supporting technical courses in mathematics, science, and engineering, and a minimum of seven courses in the humanities and social sciences.

Princeton University has its own financial assistance program and extends loans, scholarships, and work-study grants to students in need. The Center also provides students jobs to perform specific research tasks.

CURRENT FACULTY, STUDENTS, GRADUATES

The Center for Environmental Studies has a faculty membership of twenty-one persons of various academic affiliations and areas of specialization. The Center also has sixteen faculty associates affiliated with the Center and who participate in sponsored research activities. None of the faculty members are entirely supported by sponsored research grants.

During 1976-77, the support level for research amounted to $1,015,000.00. This total was comprised from funds from different agencies of the U.S. government, state governments, public utilities, private foundations, the Swedish Energekommission, and grants from private individuals. For example, the Swedish Energekommission has sponsored research on the consequences of catastrophic reactor accidents occurring at sites in Sweden. Members of the core research group receive frequent requests for faculty presentations to many types of organizations, as well as invitations to present testimony at various types of hearings.

During the 1976-77 academic year, a total of forty-four students participated in research studies. They participate in a variety of projects which include biogasification of agricultural waste and legislation to preserve critical environmental areas in Virginia. It is estimated that thirteen participating students graduate annually, and of those participating during 1976-77, eight students were female.

Most undergraduate students participating in the Center's activities continue on for advanced degrees in related areas offered by institutions such as the University of Pennsylvania or Wisconsin. Approximately fifty percent of the graduates find public sector jobs and the other fifty percent find positions with private companies such as the General Motors Corporation.

PROGRAM PROJECTIONS

There is not anticipated to be any expansion in the structure of the Center for Environmental Studies although emphasis may change into more of an energy orientation (solar energy). The Center may develop its own academic program in the future although degrees would most likely continue to be granted by departments.

The Center has recently given a greater emphasis to energy aspects in its research. Research in solar energy is new field of research concern which has been funded by the Ford Foundation. Other recent research areas of concern include energy conservation and coal use by industries.

COURSE DESCRIPTION*

Chemistry 333 Chemistry and the Environment This course discusses environmental issues in their chemical context, including energy (sources, conversion, utilization), atmosphere (climate, ozone layer, air pollution), hydrosphere (water utilization, water treatment, eutrophication) and the biosphere (food production and nutrition, pesticides, heavy metals, carcinogens).

Economics 101 The Structure and Functioning of the National Economy Economics has a particular kind of perspective to offer on environmental problems in terms of the functioning (or malfunctioning) of the pricing system.

Engineering 213 Energy and Environment: A Quantitative Approach By concentrating on environmental problems arising from man's consumption of energy, this course introduces both the Environment and Energy Topical Programs.

Engineering 241 Introduction to Chemical Engineering The fundamentals of material and energy balances are covered.

Engineering 276 Introduction to Water Resources An introductory course to acquaint students with the most important areas of water resources.

Engineering 303 Environmental Studies This course is divided into two parts. The first part surveys the philosophic, political, and economic background of environmental problems and solutions to those problems. The second part examines case studies of actual recent environmental disputes and decisions to determine how the actors and decision-makers make use (or misuse) of the philosophic, economic, and political concepts and how they used or misused scientific and technical data.

Engineering 418 Nuclear Engineering Environmental effects of nuclear power are treated explicitly as they arise in the course's development of the science and engineering of fission and fusion reactors.

Engineering 436 Air Transportation A study of the characteristics of airplanes, including noise pollution and the chemical pollutants they engender.

Engineering 441 Chemical Reactor Engineering This course discusses chemical reactions and analyses that are of importance in reaction systems, and their application to environmental and industrial problems.

Engineering 446 Biochemical Technology Fundamentals of biochemical and microbiological processes and their applications in chemical, pharmaceutical, food and waste treatment industries will be studied.

Engineering 471 Introduction to Water Pollution Technology This is a course for those who seek an introduction to the science and technology of water pollution, its prevention, and abatement.

Engineering 472 Introduction to Water Quality Problems This concerns the application of fluid mechanics to water-quality problems.

Engineering 542 Acoustics and Unsteady Aerodynamics A course in physical acoustics; particularly useful for someone who has a serious interest in noise control and wishes a sound understanding of the underlying physical phenomena.

Geological and Geophysical Sciences 412 Aqueous Environmental Chemistry This course is concerned with the chemical content of surface water, and the methods by which it is determined.

* This is a partial listing of courses offered

INSTITUTION: RUTGERS-STATE UNIVERSITY OF NEW JERSEY

PROGRAM: Environmental and Business Economics

DEPARTMENT: Agricultural Economics and Marketing

DEGREE: Bachelor of Science (B.S.)

CONTACT: Dr. Daymon Thatch
Curriculum Coordinator for Envirormental and Business Economics Program
Dept. of Agricultural Economics
Room 213, Cook Office Bldg., Cook Campus
Rutgers - State University of New Jersey
New Brunswick, New Jersey 08903 (201) 932-9270

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

In 1974, the College of Agriculture and Environmental Science deciede to offer a multipurpose multidisciplinary degree program in environmental and business economics at the baccalaureate level. The Environmental Economics option attempts to provide students with the necessary background knowledge to apply economic analyses to the solution of environmental problems. In the process, the students become acquainted with the economic ramifications of environmental problems. The curriculum is designed to introduce students to the following areas of interest in environmental economics: economic theory as applied to environmental problems; analytical and decision-making techniques used in analyzing environmental problems; and the institutional framework within which environmental problems must be solved and environmental policy can be developed. Students are prepared to enter positions in industry, government, or education and to continue study at the graduate level. Many graduates enter business economic positions in the private sector often involving sales, distribution and marketing. Facilities available for use of students in this program include computer terminals in the department for on-line problems and grant money is available as funding for these anlaytical services.

PROGRAM REQUIREMENTS

There are no special or unique requirements required of students to enter this program other than the general Cook College entrance requirements. Cook College has a policy of only accepting the top ten to fifteen percent of high school graduates in New Jersey.

In order to satisfy the requirements for the Bachelor of Science degree in Environmental and Business Economics, 36 credits of college requirements, 48 to 49 credits (12 can be used to satisfy college requirements), 21 curricular credits and 34 to 41 unspecified elective credits, must be assembled in order to obtain the necessary 128 credits for graduation.

The usual federal financial aid programs (e.g. Basic Educational Opportunity Grant) are available for Cook College students to apply for. Scholarships available include New Jersey State Scholarships, Rutgers Alumni Scholarships, and endowed and special Cook and University scholarships.

CURRENT FACULTY, STUDENTS, GRADUATES

There are 180 to 200 undergraduate students in the Environmental and Business Economics program. There are thirty students in the Master of Science in Agricultural Economics program, five are part-tiem and one-third are female. The average number of graduates annually completing the Bachelor of Science degree requirements are between 40 and 50. About ten to fifteen students annually complete the M.S. requirements. At the undergraduate level, enrollment is up and there is an annual increase of twenty students at the baccalaureate level.

Many graduates from this program continue on for advanced degrees in Agricultural economics or obtain a Masters in Business Administration. Many graduates continue on to the University of Maryland, Penn State and Cornell University. About 60 percent of the program's graduates obtain business economic positions in sales, marketing and distributing. About one-third continue on for advanced degrees.

PROGRAM PROJECTIONS

Enrollment in the Environmental and Business Economics Program has been increasing annually about 35 percent because of demand by other Rutgers students for the program's courses. It is estimated that internally, enrollment in the program increases ten to fifteen percent annually. Another master's degree program may be later developed and a joint doctorate degree program in cooperation with other programs may also be developed. In 1978 one additional faculty member is expected to be recruited and it is likely that this additional staff member will be an Agricultural Economist with a policy and natural resources economics background.

COURSE DESCRIPTION

Environmental Economics Emphasis 030:

132 Economic Growth, Man and Environment - Micro- and macro-economic considerations of environmental problems. (3 s.h.)

304 Economic Development and Public Policy - Nature and problems of economic development, with primary consideration of low-income countries. (3 s.h.)

309 Land Economics - Application of economic principles to utilization of land resources. (3 s.h.)

316 Environmental Economics - Economic theory used to explain how a broad range of environmental problems result from the operation of a market economy. (3 s.h.)

362 Agricultural Policy and World Food Problems - Economic structure and organization of the agricultural industry. (3 s.h.)

410 Natural Resource Economics - Natural, spatial, and proprietary aspects of natural resources; private and public considerations regarding conservation, resource development, policy taxation and planning. (3 s.h.)

INSTITUTION: RUTGERS - STATE UNIVERSITY OF NEW JERSEY

PROGRAM: Environmental Studies

DEPARTMENT: Environmental Studies

DEGREE: Bachelor of Science (B.S.)

CONTACT: Dr. Samuel Faust, Research Professor
Durriculum Coordinator for Environmental Studies Program
Environmental Science Department
Georges Road Laboratories, Cook College
Rutgers- State University of New Jersey
New Brunswick, New Jersey 08903
(201) 932-9571

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The Environmental Studies Program was started in 1973 when Cook College was first formed. The objective of the program is to provide students an understanding of the geological, physical, and social, and behavioral sciences and their application to human environmental problems. There are currently nine options being offered: Environmental and Pollution Sciences; Environmental Health; Water Resources; Radiation Sciences; Environmental Teacher Education; Preparation for Marine Studies; Environmental Awareness Studies; and Industrial Hygiene. A considerable degree of flexibility is provided for course selection allowing students to emphasize one or more of these areas. A program of study can be designed so that students may continue into graduate study, a professional career, teacher certification, or general environmental awareness. Few students find employment in consulting firms and many work in a governmental agency for one to two years and then return for graduate study.

PROGRAM REQUIREMENTS

Although there are no special requirements for Cook College students to take in order to enter this program, all of the program's general core requirements except the General Ecology course have to be taken by all Cook College students. Structured into the curriculum are 36 credits of general college requirements, 30 to 36 credits core requirements (12 credits may be used to satisfy college requirements) 38 credits curricular option requirements, 18 to 24 credits unspecified electives which all add up to the 128 credits required to earn the Bachelor of Science degree.

CURRENT FACULTY, STUDENTS, GRADUATES

Seven faculty members teach the bulk of the Environmental Studies Program's courses and there are 16 faculty advisers available to assist students in designing their curriculum. There are currently about 200 students enrolled in the Environmental Studies Program, all except two are full-time. Approximately 30 to 40 percent are female students. It is estimated that on the average, about 60 students annually receive their Bachelor of Science degree through the program. Although enrollment dropped somewhat during 1976-77, enrollment has increased during the 1977-78 school year.

Approximately 40 percent of the Environmental Studies graduates continue on for advanced degrees. Most continue on for the master's degree offered by the Environmental Science Department at Rutgers University. Others have continued on to Marine Science, Harvard, the Unviersity of North Carolina's School of Public Health and the Unviersity of Michigan's School of Public Health. Most of the program's graduates continue on for advanced degrees (Master of Science) after two years working in their field. Program officials estimate that 95 percent find employment in their field. About 20% find private sector jobs and 80% find public sector employment. Although few work for consulting firms, many find positions as waste treatment plant operators, laboratory technicians and water plant operators.

A placement survey covering graduates from the years 1973-1976 was recently conducted by the program and 75 replies were received from students. The survey determined that: 26 continued on to graduate school in environmental science; 30 had environmental science related jobs; 12 did not have environmental science related jobs; four were unemployed; one joined the military; one continued on to medical school; and one entered law school intending to specialize in environmental law. The program also determined that many graduates obtained environmental health related jobs and of those who went to work for state or federal environmental agencies, several found positions, relating to 208 Areawide Planning. Many graduates also found positions working for state environmental agencies.

PROGRAM PROJECTIONS

Program officials do not expect enrollment to increase significantly in subsequent years and that the only area in which expansion may be made would most likely be in the area of environmental health and industrial hygiene. An additional epidemiologist will be recruited by the program to teach new undergraduate courses in this area.

COURSE DESCRIPTION

(the following is a partial listing of courses)

Undergraduate courses 11-375:

301 The Environment and Health - Areas in the enviornment that affect man's well-being; particular emphasis on areas other than air and water. (3 s.h.)

302 Elements of Water and Wastewater Treatment - Introduction to those unit operations which constitute the state of the art of water and wastewater treatment. The course will stress practice as well as principle and will be prepared so as to give the students a working knowledge of conventional systems in order to prepare his/her for a role in the pollution sciences area. (3 s.h.)

303 Pollution Microbiology - Microorganisms as polluters and purifiers of the enviornment. Problems resulting from biological cycling of carbon, nitrogen, and other elements. Sewage and solid waste treatment; sanitary bacteriology. (3 s.h.)

403 Environment and Public Health: Epidemiological Apsects - Epidemiologic investigation as a tool for studying diseases, infections and non-infections in human populations; emphasis on the interrelationships among host, agent and environmental factors. (3 s.h.)

405 Fundamentals of Water and Wastewater Analysis - Quantitative analysis of water and wastewater with particular reference to sampling and specific analyses applicable to each field. (4 s.h.)

406 Public Health Practice and Administration - Identification and control of community health problems considered in relation to environmental stresses that impair functioning and productivity of the individual. (3 s.h.)

407 Environmental Toxicology and Epidemiology - Basic principels and applications of epidemiology and toxicology of environment (air and water pollutants). (3 s.h.)

421 Principles of Air Pollution Control - Fundamental factors responsible for atmospheric contamination; effects of pollution on man and his environment; basic principles of measurement and survey; methods of control; air cleaning; legal aspects involved. (3 s.h.)

422 Air Sampling and Analysis - Methods for collection and analysis of particulate and gaseous pollutants. (3 s.h.)

423,424 Environmental Physics - Application of basic physical concepts to the environmental sciences including environmental physics, radiation science, meteorology, etc. (3 s.h.)

425 Radioactivity and the Environment - Atomic and nuclear radioactivity, fission and fusion, interaction of radiation with matter, biological effects and radiation exposure limits, sources of environmental contamination, radioactive waste treatment and disposal. (3 s.h.)

434 Principles of Industrial Hygiene - Identification, evaluation and control of chemical and physical stresses of the industrial environment. (3 s.h.)

444 Water Resources - Water Quality - Introduction to the chemistry and microbiology of natural and polluted waters. Definitions and samples of water quality. Chemical and biological stability of organic compounds in polluted water examined. (3 s.h.)

493 Applied Health Physics - Basic concepts and practices of radiation protection. Designed for personnel involved with the use of ionizing radiation sources and radioisotopes. (1 s.h.)

Environmental Resources:

11-372:

202 Current Environmental Problems - Review of major trends in contemporary society. (3 s.h.)

203 Human Modification of the Landscape - Analysis of man-made changes in the physical landscape of urban and rural areas. (3 s.h.)

231 Fundamentals of Environmental Planning: Techniques - Principles of environmental planning related to the planning process. Special emphasis on natural principles of land use. (3 s.h.)

307 Environmental Systems: Polar Region - Review of the present status of knowledge of polar environmental systems. (3 s.h.)

381 Introduction to Environmental Systems Analysis - The philosophy of the systems approach. Structure of systems. Principles of environmental systems analysis. (3 s.h.)

411 Elements of Environmental Planning - Exercises in environmental problem situations requiring comprehensive solutions used to focus on potentially useful and practically oriented plans and policies as well as to evaluate environmental planning techniques. (3 s.h.)

INSTITUTION: RUTGERS - STATE UNIVERSITY OF NEW JERSEY

PROGRAM: International Environmental Studies

DEPARTMENT: Human Ecology and Social Sciences

DEGREE: Bachelor of Arts (B.A.); Bachelor of Science (B.S.)

CONTACT: Dr. David J. Rosen
Acting Director, International Environmental Studies Program
212 Cook Office Building, Cook College
Rutgers, State University of New Jersey
New Brunswick, New Jersey 08903
(201) 932-9153

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

Cook College, a division of Rutgers University, offers this new curriculum in International Environmental Studies at the undergraduate level. The program was first approved in July, 1975, by the New Jersey Board of Higher Education and was supported by a grant from the U.S. Office of Education. It was developed in cooperation and with the endorsement of the United Nations Environment Program. Through this program students can prepare for careers in agriculture, business, finance, trade, health care, public administration and law.

Activities are sponsored for faculty, students, and the community for developing general awareness and understanding of international environmental issues. A series of faculty development seminars are held by the program and Rutgers faculty and other visiting speakers are invited to discuss their activities and how they relate to topics concerning international environmental issues. Symposia are also sponsored focusing on topical issues as the U.N. Law of the Sea Conference, international environmental education, and problems in the historical and comparative study of social response to environmental challenges.

Options available in this program include: Agriculture and Food; Earth, Oceans, and the Atmosphere; Human Health; and International Institutions and Law. Students, with the advice and approval of the faculty, may also design an individual option geared to their interests or goals. Among the areas covered during this program are:

(1) regional and national differences in the availability, production, and uses of environmental resources;

(2) the interdependence of nations and regions with respect to physical, biological and social phenomena;
(3) cultural variations in the identification of and response to environmental stress;
(4) alternative strategies in international environmental management;
(5) ethical and moral components of global environmental issues;
(6) the functions and roles of transnational corporations and national and international agencies in dealing with international environmental problems;
(7) some of the physical, environmental, political, economic, and social aspects of energy within a global context.

PROGRAM REQUIREMENTS

There are no special requirements or prerequisites for students entering this program although they are expected to meet the general requirements to be admitted to Cook College. The curriculum is designed to facilitate maximum flexibility in the choice of courses focused on specific problem areas. Thirty-six credits of general college requirements, 27 hours of required courses (6 credits may be used to satisfy college requirements), a minimum of 30 credits of required options and electives and 33 credits of unspecified electives are required in order to earn the 128 credits required for the B.A. or B.S. degrees.

Although this program does not yet have a special internship program developed for its students, a couple of International Environmental Studies students currently participate in the Cook College Co-op Program in which they work full-time one semester plus a summer. International Environmental Studies students have access to the University computer center for carrying out their studies.

Although the program's students are not offered any special form of financial aid in order to complete their studies in this area, Cook College students have opportunities to apply for New Jersey State Scholarships, ROTC scholarships, Rutgers Alumni Scholarships, and endowed and special Cook College and Rutgers University scholarships. The other normal federal programs are available to Cook College students.

CURRENT FACULTY, STUDENTS, GRADUATES

There are ten faculty members who are intensively involved in the offering of the International Environmental Studies curriculum and they represent various disciplines such as geography, anthropology, political science, physics, law, geography, food science, plant science, economics, and oceanography. In addition, other faculty members will work with students who elect particular options or specializations. Outside of the core or required courses students may select courses from any of the undergraduate divisions of the University.

At the present there are 30 students majoring in the program, of whom 12 are female. Enrollment has been steadily increasing since 1975 when the program was first offered to Cook College students. Although there have only been two graduates since 1975 because of the newness of the program, it is anticipated that nine students will complete their degrees in June, 1978, and that this level will be maintained.

Both of the programs' two graduates have continued on for advanced degrees. One went to study law at Georgetown University and the other is enrolled in the graduate economics program at Rutgers University. It is too early to determine employment trends at this time because of the newness of the program.

PROGRAM PROJECTIONS

Because of the structure of the program, faculty can be drawn from existing departments to offer courses at Rutgers, Livingston, Cook or Douglas Colleges. Additional courses can be developed if needs are perceived and existing faculty members can be drawn upon to teach these additional courses. Because of student interest, it is expected that additional agricultural courses will be offered in the future.

The current enrollment of 30 students in the program represents a steady increase over the three years of the program's existence and program officials speculate that enrollment will ultimately level off at 40 to 50 students. Because students from other programs also take International Environmental Studies courses, this figure does not completely determine class sizes. Officials would like to maintain present class size (which varies from 15-30) and while they expect enrollment in environmental programs to level off, they believe that the focus or emphasis may change as new environmental issues increase in salience.

COURSE DESCRIPTION

(the following is a partial listing of courses)

11-559:215 Introduction to International Environmental Studies - Comparative survey of major international environmental problems; emphasis on problems of classification, regional and cultural variations in the identification of and response to environmental stress, alternative strategies in international environmental management, and the ethical and moral components of global environmental issues. (3 s.h.)

11-559:301 Environment and Development - Analysis of differences among nations in development policies and the associated definitions of environmental problems in relation to socio-economic, ecological, and political variables. (3 s.h.)

11-559:312 Environmental Problems in Historical and Cross-Cultural Perspective - Comparative study of the historical experience of selected Old and New World societies in evolving strategies for adjusting to environmental constraints and opportunities, and other topics. (3 s.h.)

11-559:314 Energy in World Perspective - Basic scientific, technological, economic and political aspects of energy; their relation to supply and use of energy in an international perspective. (3 s.h.)

11-559:402 Senior Colloquium in International Environmental Studies - Required courses for senior international Environmental Studies majors. Focus on a different topic each year. Taught jointly by several faculty members. (3 s.h.)

11-372:321 International Environmental Law - Environmental law in its international and comparative aspects. Emphasis on the nature of international law and the implications of its development for actual legal systems. (3 s.h.)

INSTITUTION: SANGAMON STATE UNIVERSITY

PROGRAM: Environments and People

DEPARTMENT: Environments and People

DEGREE: Bachelor of Arts (B.A.)
Master of Arts (M.A.)

CONTACT: Dr. Malcolm P. Levin, Coordinator
Environments and People
Sangamon State University
Springfield, Illinois 62708
(217) 786-6720

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The program is interdisciplinary with departmental status. Because of the upper divisional status of the University, only junior, senior, and master level courses are offered. Although the program is part of the natural science cluster, faculty members represent the humanities and social sciences as well as natural sciences. The focus is on the interrelationships between people and their environments with people considered as forming parts of biologically and culturally adaptive systems.

PROGRAM REQUIREMENTS

The program requires all B.A. and M.A. candidates to take 12 credit hours of core courses: ENP 452, Environmental Social Science; ENP 453, Environmental Natural Science, and four elective hours of either social science or laboratory science as determined in consultation with student's adviser. In exceptional cases, either ENP 452 or ENP 453 may be waived. It is strongly recommended that the student take these courses early in the concentration.

Any student with at least 60 semester hours acceptable to Sangamon State University may enter the Environments and People Program. A minimum of 28 credit hours (normally seven four-hour courses) in the program is required for the B.A. degree. Program approval is required for more than three cross-listed courses applied to the concentration.

Because interactions between human societies and natural environments have many implications, the Environments and People Program is centered around thematic study areas. A theme deals with a specific aspect of the more general interactions between societies and ecosystems. Emphasis is on individual particpation in designing a theme reflecting a student's own environmental educational needs and objectives. Examples of themes include: population dynamics, bioecology, environmental history, environmental economics, resource management, and environmental policies. A student must file, by the end of the second semester of study, a prospectus that details the intended theme. The prospectus may be amended at a later date. It is highly recommended that the advisers of majors in the program be active members of the Environments and People Program committee.

A total of 40 semester hours is required for the M.A. degree. Credit hour distribution requirements, which must be met by the candidate, vary by M.A. concentration. The program offers four concentrations in the M.A. degree.

1) Individualized Environmental Studies: In consultation with an adviser, the student develops a theme that is a reflection of his/her environmental educational and career aims and objectives.

2) Environmental Administration: The purpose of this concentration is to prepare students to interact with and to function effectively in bureaucracies while understanding and maintaining a commitment to environmental integrity.

3) Environmental Economics: The emphasis in this concentration is to enable students to understand and work with economic considerations in environmental decision-making.

4) Environmental Methodologies: The purpose of this concentration is to enable students to understand the procedures of data collection, to have basic computer skills, to understand modeling systems, and to communicate effectively with various scientific disciplines.

CURRENT FACULTY, STUDENTS, GRADUATES

Sangamon State is a teaching, rather than research oriented, university; thus no part of the faculty load is for research. The program currently has five full-time cost-centered faculty and five contributing faculty members (some professors cost-centered in other programs and some part-time adjunct instructors).

The program attracts many career change and career enhancement students as evidenced by the large proportion of employed, part-time students, especially at the graduate level. Nearly two-thirds of all the students are part-time (42 of 68). Of the M.A. students, 31 of the 39 are part-time. Many of the M.A. students are already employed in environmentally related jobs, most with state agencies.

An applied study term (frequently a state agency internship) is required of all undergraduates and is optional for graduate students. Several program graduates have been placed in positions as a direct result of the applied study experience. Approximately 50 percent of the graduates are already employed or find employment in their field. Another 25 percent are employed or find jobs in related fields. Nearly 80 percent are employed in the public sector; 5 percent in the private sector; and about 15 percent work for non-profit organizations.

PROGRAM PROJECTIONS

Although enrollment in the program has been increasing steadily, whereas the university overall enrollment has dropped; no expansion is forecast due to a tight fiscal situation. The program will continue to make extensive use of faculty from other programs and part-time instructors to provide specialized courses.

ADDITIONAL INFORMATION

The Environments and People Program is responsible for an agency based off-campus degree program offered in Schaumburg, Illinois, to employees of the Illinois Department of Transportation. Sixteen graduate students are enrolled. Program faculty also teach courses at the Sangamon State Universtiy off-campus center in Peoria. Workshops for Illinois Environmental Protection Agency personnel have been conducted on campus. The program served as host to the Environmental Education Association of Illinois fall conference in 1976.

The Clayville Rural Life Center, located 12 miles west of Springfield, is used as a teaching-practicum site for midwest environmental history courses within a 19th century setting.

COURSE DESCRIPTION (the following is a partial listing of courses)

Core Courses: ENP451 Ecosystems, Value Systems, Social Systems - Emphasizes interactions of society within bioecosystems and bringing this ecological approach into the social-cultural world of human activity. Includes energy flows, matter flows, stability of ecosystems, human population dynamics, resource consumption, cultural values, institutions, and environmental decision-making. (4 s.h.)

ENP452 Environmental Social Change - Knowledge of social science is necessary to understand and solve environmental problems. Basic concepts of the social sciences - anthropology, economics, history, political science, sociology - are studied to bring the social world into perspective as an integration of structures, processes and functions and to understand basic patterns and alternative patterns of the relationship of human society to the biological and physical world. (4 s.h.)

ENP453 Environmental Natural Science - Knowledge of science is necessary to understand and solve environmental problems. Basic concepts of the natural sciences - geology, physics, chemistry, biology, ecology - are studied to bring the biological and physical world into perspective as an integrated continuum of structures, processes and functions. (4 s.h.)

Environmental History: ENP411 Midwest Rural Life and Its European Background - Examination of contributions of English, French, German, Norwegian, and other groups in shaping the Midwest, using methods and questions from social history, cultural geography, and folklife studies. Focuses on natural environment, material culture, and values. (4 s.h.)

ENP413 Midwest Rural Life and Its American Regional Background - Study of Midwest culture and the folk and popular cultures which have contributed to it. Interdisciplinary approach used to understand relationships of such factors as natural environment, buildings, and food with social patterns and values. (4 s.h.)

ENP415 Workshop in Rural Life - Introduction to living history and rural life studies at Clayville. Students discover how to use museums, libraries, and contemporary landscapes as resources; learn select farm and household tasks and crafts; and assist in historic building reconstructions. (4 s.h.)

ENP417 Environmental History, A Problems Approach - Basic environmental problems; these are not new. Investigations into the past can provide a clearer perception of the present. Actions of other societies are compared to our present and future alternatives. (4 s.h.)

Environmental Sociology: ENP421 Sociology of Natural Resources - Examination of social meanings, role, and impact of nature and natural resources for human society and the effect of the nature of human society on natural resources and ecosystems. (4 s.h.)

ENP422 The Population Controversy - Examination and analysis of major schools of thought on overpopulation and their implications for change. What is the nature of the problem? What are important factors? What interrelationships are there between population dynamics and other social concerns? (4 s.h.)

ENP423 Issues in Population: Policy and Action - Study of what is involved for human populations to control their own growth. Considers "optimum" population, possible consequences of different social action for achieving population control, and new social issues arising from stable population or zero population growth. (4 s.h.)

Land and Resources: ENP337 Wildlife Resources - Survey of fish, bird, and mammal resources of North America from historical, taxonomic, ecological, and management points of view. For both

ENP337 (Cont'd) - science and nonscience students who want an overview of wildlife conservation. (4 s.h.)

ENP433 People's Energy Needs - Readings and discussion on energy problems, background and future prospects: Why do we have an "energy crisis"? How long will it last? How flexible are our energy demands? What alternative sources of energy might we use? (4 s.h.)

ENP434 Water Resources - Study of water problems, quantity and quality; water needs; impact on the physical-natural environment of additional human use of water, water hazards as flooding, erosion, drought; government agencies and management of water resources. (4 s.h.)

ENP435 Biology of Water Pollution - Effects of pollution by organic wastes; industrial chemicals, and thermal discharges on river fauna and flora; waterborne diseases; detection and measurement of water pollution. (2 s.h.)

ENP436 Land and Resource Use: Environmental Analysis, Policy and Planning - Introduction to land and resource use practices. Includes land-use policies; politics and economics of land and resource use; and survey of land and water-use rights development in the Midwest.

ENP437 Land-Use Planning: Principles and Practices - Examination of principles of land-use planning, with examples of successful and unsuccessful human and environmental accommodations. Includes aesthetic considerations in land-use planning and current federal, state, and local statutory law and impacts on land and resource use and allocation. (4 s.h.)

Bioecology: ENP441 Heredity, Evolution, and Society - Evolution as a unifying principle of biology. Emphasis on application of mechanisms of heredity and evolution to societal and institutional problems. Assesses genetics aspects of agriculture, environmental hazards, population, biomedical engineering, and others. (4 s.h.)

ENP442 Ecology and Society: Implications for Public Institutions - Implications of man's activities within the context of change. Change viewed as a process in natural systems preventing overspecialization and simplification. Complexity and its survival value examined in contrast with man's attempt to achieve stability through simplicity. (4 s.h.)

ENP443 Ecology and People - Examination of principles of ecology and biological systems. Considers relationship between biological principles and environmental problems. Presents biological alternatives as problem solutions. Topics include diversity and stability, energy flow and analysis, meaning of species extinction, systems modeling. (4 s.h.)

Environmental Geography: ENP462 - Geography--Life Geosystems - Considerations of earth's life support systems in terms of what humans need from and their impact on the natural environment. Examines energy, oxygen-carbon dioxide, water, land, food, material resources systems. Variations between countries, urban and rural inhabitants, and different value sets considered. (4 s.h.)

ENP463 Environmental Climatology - Focus on energy and moisture fluxes of the atmosphere. Processes of energy and water exchange which provide life and motion to the biosphere are discussed. Global and local climatic change receives special attention. (4 s.h.)

ENP469 The Historical Geography of the United States - Study of sequential and regional growth of the United States emphasizing the impact of physical environment. Includes historical-geographical factors in the settlement and growth of Illinois and neighboring states. (4 s.h.)

Environmental Humanities: ENP470 Mornings at Clayville - Practicum in historical and environmental interpretation. Students take part in the program for fifth-graders and work with children as they engage in cooking, gardening, and other activities of the 1850s at Clayville Rural Life Center. Some written work expected. (2 s.h.)

ENP471 Environmental Education - Solutions to environmental issues and problems are sought on two levels: that of the environmental problems and issues themselves; that of effectively increasing awareness and affecting behavior of students. (4 s.h.)

ENP472 Interpretive Workshop - Helps students to plan, research, and carry out living history programs; to deepen awareness of the natural environment and cultural heritage. Field trips to historic sites and state parks. Projects include interpretive planning, program assistance, and evaluation. (4 s.h.)

ENP474 Environmental Perception - Study of perception of and responses to natural environments. Analysis of the eye and other senses as perceptual systems; landscape interpretations; concepts of aesthetics; and environmental metaphors, images, and symbols. (4 s.h.)

ENP477 Expressions of American Naturalism: From Colonial Days to Wendell Berry - Study of historical and literary sources, with artistic representations, in chronological order, to uncover the growth and change of Americans' attitudes toward their natural environment. Selections from Jefferson, Cooper, Audubon, Emerson, Thoreau, Whitman, Cather, Sandburg, Frost, and others. (4 s.h.)

Environmental Politics and Action: ENP481 Dignity and the Wasteland: Nature in the Political Tradition - Study of important political thinkers in order to clarify how environmental ethics bear on civic action. Is the good environmentalist a good citizen? (4 s.h.)

ENP482 Energy and the Environment - Relates energy principles to environmental affairs. Energy is the ultimate resource: considerations of its uses must be the basis for environmental analysis and planning. Systems analysis used for analyzing environmental problems and planning practical applications of energy policy. (4 s.h.)

ENP483 Environmental Policies - Environmental issues as they relate to existing federal, state, and community regulations. Topics include land-use planning, water resource development, energy, National Environemental Policy Act, air and water laws, and environmental economics. (4 s.h.)

ENP485 Citizen Action in Environmental Affairs - Research, writing, and presentation of testimony on selected topics that come before the Illinois Pollution Control Board. Supplementary work involves producing environmental reports relative to regional environmental problems. (4 s.h.)

ENP487 Environmental Law and the Citizen - Examination of how citizens can participate in legal processes to work toward resolution of environmental issues, the citizen's role in public hearings, litigation, class action suits, appeals processes included in providing student knowledge of state and federal environmental law. (4 s.h.)

ENP488 Environmental Law and Illinois Government - Relation of environmental issues and their legal implications to Illinois agencies. Case law, litigation, and limits of legislated authority examined in relation to selected environmental problems. Special attention to legal relationships between state agencies, federal agencies, and the public. (4 s.h.)

Biology: BIO371 Principles of Ecology - Structure and function of ecological systems including basic ecological principles and concepts; the habitat approach with major units of both aquatic and terrestrial ecosystems. Laboratory involves in-depth study of terrestrial communities. (4 s.h.)

BIO481 Plants and Civilization - Interrelationships of plants and man in his evolution and cultural development. (3 s.h.)

Economics: ECO474 Environmental Economics - Designed to acquaint the student with basic theoretical tools necessary to examine current environmental problems from an economic standpoint. Covers externalaties, cost assignment, and environmental problems associated with economic growth. (4 s.h.)

Physical Sciences: PHS421 Energy Resources - Examination of new technologies, environmental consequences, and implications of major energy options. Provides synopsis of literature available in this field. (4 s.h.)

PHS422 Solar Energy: Principles and Applications - Introduction to principles of solar energy and its technological applications to society's energy needs. Includes: physics of solar radiation; measurement of solar radiation; climatic factors associated with solar flux on earth; interaction of solar radiation with matter; applications of solar energy in heating, distillation, cooling, electric power generation; economics of solar energy technology; environmental factors; survey of present commercial applications. Laboratory includes practical applications utilizing solar energy experimental site at SSU. (4 or 5 s.h.)

PHS423 Environmental Geology - Basic geological concepts as related to man's activities: geological hazards; land-use planning; waste disposal; resources, including water; land reclamation. Examples from within Illinois. (4 s.h.)

Sociology/Anthropology: SOA441 Techniques and Utilization of Demography - Study of population variation and change, techniques of studying demographic data, and explanation of the social forces involved in population change. (4 s.h.)

INSTITUTION: THE PENNSYLVANIA STATE UNIVERSITY

PROGRAM: Environmental Resource Management

DEPARTMENT: Interdepartmental - College of Agriculture

DEGREE: Bachelor of Science (B.S.)

CONTACT: Dr. John R. Daugherty
In Charge of Environmental Resource Management Program
201 Ferguson Building
The Pennsylvania State University
University Park, Pennsylvania 16802
(814) 865-6942

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

Started in 1971, the Environmental Resource Management Program was revised in 1975 from a generalist emphasis to emphasize specializations in order to allow students to meet job market criterion. This interdepartmental major is designed to train students to help resolve the conflicting demands for the utilization of natural resources and to develop rational programs for the use of the environment. Graduates have broad training and problem solving ability in areas such as applied biology and ecology, environmental quality, management of the various renewable resources, economics, and the related social sciences and humanities.

Graduates are qualified (depending on their technical course selections) to serve in specialized areas such as resource manager, soil conservationist, land manager, and environmental protection specialist. They are qualified to analyze complex environmental and pollution problems, to prepare and evaluate environmental impact statements, and to develop integrated plans for the multipurpose use of natural resources. They obtain employment with governmental agencies at the federal, state, regional, and local levels or with public utilities and industries which use or affect renewable resources. The major also prepares students for graduate work in one of the specialized areas of environmental science. Students in the program have access to the College of Agriculture's research and study facilities.

PROGRAM REQUIREMENTS

In order to enter baccalaureate degree programs in the College of Agriculture, three secondary school units of English and 12 units from other subject areas are required. The College of Agriculture recommends, but does not require for admission, 3 units each of science and mathematics, including trigonometry.

The Bachelor of Science degree in Environmental Resource Management requires a total of 135 semester credits for graduation. Included are 80-85 credits of baccalaureate degree requirements, 46 credits of major requirements, and 6-9 credits of electives. Graduation requirements for this major include the completion of the following university level courses:

- 4 courses (12 credits) in communication skills, including a course in technical writing;
- 4 courses (10-13 credits) in statistics, calculus, and computer science;
- 10 courses (27-30 credits) in the natural and biological sciences, including biology, botany, zoology, ecology, wildlife, plant growth and development, and microbiology;
- 5 courses (14 credits) in the physical sciences, including chemistry and physics;
- 3 courses (9 - 10 credits) in the area of geology, soils, and water management;
- 5 courses (15 credits) in the area of economics, land economics, political science, management, and the various legal aspects of environmental problems;
- 4 courses (12 credits) in the social sciences and humanities; and
- 3 courses (9 credits) related to environmental pollution and to the systematic analysis of environmental problems and resource problems.

In addition, graduates from this major will have completed 3 to 6 technical courses in a specialized area, of the student's choice, related to environmental quality or to resource management.

The College of Agriculture administers an internship cooperative program with U.S. Steel, planning commissions, sewage treatment commissions, McKeever Environmental Center, the U.S. Forest Service, and the U.S. Soil Conservation Service. Four students participate in training a training program run by American Cynamic Corporation to sell pollution control equipment and prepare water pollution abatement programs.

Most of the students enrolled in the program receive financial assistance from the normal federal programs (e.g., Basic Educational Opportunity Grant Program). The College of Agriculture does provide some funding and course loans.

CURRENT FACULTY, STUDENTS, GRADUATES

Only one full-time faculty member is attached to this program, although there are thirteen faculty advisors representing six departments available to assist students enrolled in the program. Eight different programs from three different Colleges of the University are involved in the teaching of the Environmental Resource Management curriculum, plus the College of Engineering's Civil Engineering Department (water pollution control). Ten instructors teach major field courses and technical field courses can be taught by any number of departments, depending on the student's emphasis.

There are currently a total of 583 students (114 female) enrolled as full-time students. There are no part-time students enrolled in this program. Enrollment has significantly increased from the 1976-66 school year when 534 students were enrolled.

An annual average of 110 students complete the program and receive the B.S. degree. A total 116 students received the degree in 1977 and there were 101 graduates in 1976. Enrollment is up so it is anticipated that a total of 150 students will receive the B.S. degree in 1978.

Only ten percent of the program's graduates continue on for advanced degrees. Two-thirds of those continuing stay at Penn State and obtain degrees such as the M.S. in Wildlife Management or Biology. Others enter fresh water programs offered by the University of Washington or Wisconsin or continue on to Colorado or Michigan State Universities.

Approximately 60 percent of the program's graduates find employment directly in their field. About 10-15 percent find professional positions in a related field and 15-20 percent find unrelated jobs. At the present time, governmental agencies are hiring relatively few persons in the field because of funding cut backs. Students in the upper half of their class, and with good, solid, cohesive technical course groupings are doing relatively well in the job market. Participation in summer trainee programs, jobs, and practicum work in the student's area of interest also enhance placability. Recent trends indicate that about one-half of graduates find private sector jobs and the other one-half find government positions.

PROGRAM PROJECTIONS

Recent increases in enrollment have forced the program to offer courses twice a year rather than once (e.g., Case Studies, Agronomy, Agricultural Engineering). The faculty is expanding the offering of programs. There is not expected to be any change in the present structure because of the recent modification that has been accomplished from a generalist structure to offering technical specializations. Program officials would like an environmental pollution monitoring laboratory course for their students. The program is attempting to obtain access to a laboratory with pollution measurement equipment, in order that students can utilize its facilities.

COURSE DESCRIPTION

The following seven Environmental Resource Management courses are to be taken as core requirements. In addition, the program has available tehcnical courses to enable a student to specialize so as to develop competency in some area. Specialized technical courses aer available from the following groupings: Pollution Control; Biology-Ecology; Environmental Health; Soil Resources; Resource Economics; Environmental Policy; Freshwater Resources; Wildlife Resources; Air Pollution; Marine Resources; Pests and Pesticide Management; Societal Resource Organization and Distribution; Energy Production; Forest Resources; General Resource Management; and Business.

300 Junior Seminar - Discussion of selected topics in environmental resource management by staff and representatives of government and industry. (1 s.h.)

400 Senior Seminar - Preparation and presentation of a report covering a specific topic in environmental resource management. (1 s.h.)

401 Special Studies - Supervised independent study. (1-8 s.h.)

410 Legal Aspects of Resource Management - Legal systems and lawmaking processes, property rights in land, water and wildlife resources; jurisdictional problems in planning resource use. (3 s.h.)

411 Legal Aspects of Resource Management - Legal systems and lawmaking processes, property rights in land, water and wildlife resources; jurisdictional problems in planning resource use. (3 s.h.)

412 Resource Systems Analysis - The concept of systems; techniques of analysis, including input/output, mathematical programming, and simulation; application to resource systems. Prerequisites: 6 credits in mathematics, 3 in statistics, and 3 in ecology. (3 s.h.)

413 Case Studies in Ecosystem Management - Application of biological, physical and social science principles to ecosystem management problems; introduction to environmental impact statement preparation and review. Prerequisites: 6 credits each in the biological, physical, and social sciences. (3 s.h.)

INSTITUTION: UNIVERSITY OF CALIFORNIA AT SANTA BARBARA

PROGRAM: Environmental Studies

DEPARTMENT: Environmental Studies

DEGREE: Bachelor of Arts (B.A.) in Environmental Studies

CONTACT: Dr. Arent H. Schuyler, Jr.
Lecturer, Environmental Studies
University of California
Santa Barbara, California 93106
(805) 961-2881

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

Environmental studies at the University of California - Santa Barbara, is a multidisciplinary program which was established in 1970. Graduates of this program are prepared for occupations which require the skills and knowledge inherent to the management of environmentally related endeavors. The graduates of this program are well-equipped to address a broad range of problems and solutions created through man's interaction with the natural environment. Occupations, which are indicative of this program graduate's job interests span the environmental areas of air, noise, solid waste, radiation, water and wastewater, and include such positions as wastewater treatment plant technician, bacteriologist, air pollution control technician, noise abatement technician, and solar energy technician.

The major emphasis of this program of environmental studies is on a problem-oriented major. Students study environmental problems and approaches to solutions of these problems.

PROGRAM REQUIREMENTS

The program requirements at the lower division level include: ES 11, 12, 13, 14, 15, 16; and, introductory statistics. At the upper division level, students are required to complete successfully: ES 197AB or 197DE (six quarter hours); and, 32 additional quarter hours chosen and approved from the areas of anthropology, biology, botany, economics, English, geography, geology, mechanical engineering, nuclear engineering, religious studies, political science, sociology, zoology, and/or environmental studies. In addition, students must complete the general education requirements of the university.

In 1973, an internship program was established, for the purpose of giving environmental studies students practical experience in areas of their special interest. Approximately 30% of the students participate in the internship program.

CURRENT FACULTY, STUDENTS, GRADUATES

The current faculty involved in teaching and research responsibilities in the area of environmental studies includes 27 part-time faculty. One is full-time and teaches exclusively, six are involved in research and the remaining 20 are part-time environmental studies teaching faculty. All are partially subsidized by the department.

Enrollment in the environmental studies program presently includes 445 full-time and 5 part-time students. Of the total 450 students, 45% are male and 55% are female. Annually, the program graduates approximately 120 persons. The number of graduates has remained stable over the last three years.

PROGRAM PROJECTIONS

Plans are currently underway to make the requirements for this program more rigorous. Consequently, the faculty feel that a slight decrease in enrollment and graduates will occur. Of special interest to the faculty, at present, is the possible development of graduate work in environmental impact assessment. No time-lines have been established, as yet, for this program addition. Two full-time equivalent faculty members are anticipated to join the staff within the next two years.

COURSE DESCRIPTION (selected)

ES 11 The Social Environment - Concepts of history, economics, and political science that aid in understanding man's attitudes toward and management of the environment. (5 q.h.)

ES 12 The Land and Water Environments - An examination of land and water problems. (4 q.h.)

ES 14 The Air Environment - A study of man's effect on air quality. (4 q.h.)

ES 15 Energy and the Environment - A survey of man's present and future use of energy. (5 q.h.)

ES 16 The Urban Environment - A multidisciplinary approach to environmental problems arising from urbanization. (5 q.h.)

ES 105 Advanced Solar Energy and the Environment - Each major solar energy field is investigated in detail. (4 q.h.)

ES 125 Principles of Environmental Law - An introduction to the history and methodology of law as it relates to man's use of the environment. (4 q.h.)

ES 126 Environmental Law: Advanced Study and Practice - A detailed analysis and practical experience in selected areas of environmental law. (4 q.h.)

ES 135 Principles of Environmental Planning - An introduction to the theory of urban, regional, national, and international planning for responsible use of the environment. (4 q.h.)

ES 165A-B-C Environmental Impact Analysis - Field methods approach to environmental assessment preparation with an emphasis on understanding data and terminology collected by technical experts that must in turn be synthesized into a final environmental impact report. (4 q.h. each)

ES 180A-B Studies of Regional Environmental Problems - Detailed study of the environmental characteristics and problems of a particular area. (4 q.h. each)

ES 192 Internship in Environmental Studies - Opportunities to learn about practical approaches to environmental problem-solving. (1-12 q.h.)

Chem 101 Problems in Environmental Chemistry - The chemistry of air, water, and soil pollution. (3 q.h.)

PolSci 190C Laboratory Seminar in Environmental Policy Problems - An examination, through computer-based gaming and simulation of selected problems in environmental policy. (3 q.h.)

Soc 121 Environment and Society - Impact of social institutions on human-environment relations. (4 q.h.)

INSTITUTION: UNIVERSITY OF FLORIDA

PROGRAM: Systems Ecology; Environmental Resources Management Activities

DEPARTMENT: Environmental Engineering Sciences

DEGREE: Master of Engineering (M.E.), Master of Science (M.S.), Engineer, and Doctor of Philosophy (Ph.D.)

CONTACT: Dr. E. E. Pyatt, Chairman
Department of Environmental Engineering Sciences
University of Florida
Gainesville, Florida 32611
(904) 392-0841

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

Departmental status was authorized in 1966 by the Board of Regents. In an effort not to undermine environmental endeavors of other departments, its first name was the Department of Bio-environmental Engineering, but in 1968 it was renamed the Department of Environmental Engineering Sciences.

Environmental engineering is an extremely broad field; the result being several areas in which the student may specialize including: air pollution, environmental biology, environmental chemistry, environmental resources management, radiological health, solid wastes, systems ecology, water pollution control, and water supply.

Systems Ecology - Ecological Engineering is aimed at preparing a professional who can guide the harmonious interfaces of man and nature for resource management agencies, industries, planning groups, and governmental organizations. The content of the degree includes ecology, broad environmental science, engineering techniques, systems methods, and some particular means for effective management of ecological systems, and of development of energy alternatives. Cost benefits evaluations, impact statement preparation, models for decision making, economic-ecological interfaces, and the means for estimating the condition of ecological subsystems are all taught.

The multidisciplinary nature of systems ecology requires a wide spectrum of teaching and research facilities. Laboratories are available on a cooperative basis with the other departments on campus which traditionally have been involved in ecological research.

Environmental Resources Management, a program not altogether unlike that of Systems Ecology - Ecological Engineering, is designed to prepare engineers and scientists with broad understanding of environmental interactions and analytical capability for manipulating their effects in a beneficial manner. This specialist attempts to make efficient allocation of resources with due regard for that which is socially desirable and that which is economically feasible. The decision-making process is enhanced by the application of mathematical techniques emerging from systems engineering and operations research.

Research in the area of environmental resources management seeks to define alternatives and determine optimal strategies in dealing with environmental problems. Commonly, the use of digital computers is necessary for conducting data analyses and these are readily available for student use.

PROGRAM REQUIREMENTS

Admission to the University of Florida's Graduate School requires an undergraduate degree from an accredited institution with a 3.0 average (on a 4.0 scale) during the junior and senior years, Graduate Record Examination scores, and other evidence of one's ability to do graduate level work.

Two master's programs are available to graduate students in Environmental Engineering Sciences, depending on their educational background and professional goals. Students possessing undergraduate degrees in engineering or a basic science may pursue the Master of Science degree through a program in Environmental Sciences. A program in Environmental Engineering leads to a Master of Engineering degree which is accredited by the Engineers' Council for Professional Development. Other persons entering this program will be required to take sufficient articulation work to bring their backgrounds into agreement with those having undergraduate engineering training.

Students who plan to pursue a doctorate degree are encouraged to prepare a master's thesis; however, others in either the M.S. or the M.E. program have the option of doing a thesis or not. If the thesis option is not chosen, students must prepare a technical paper which is to be presented at a seminar during the final quarter in residence. The minimum registration for a master's degree and a thesis is forty-five quarter credits, thirty-six of which are to be taken in course work, and nine in thesis preparation. Thesis option students must take at least eighteen units of Environmental Engineering Sciences course work and at least eighteen units of graduate level courses (numbered 600 or higher). The non-thesis option requires a minimum of fifty-four units, twenty-seven of which must be taken within the department, and at least twenty-four at the 600 level or higher. These courses may constitute a coherent minor, or they may be spread over other disciplines.

The departmental core requires environmental biology, environmental chemistry, statistics, and computer programming of all students, but beyond this, it is the responsibility of the student and his/

her supervisory committee to approve what program of courses is selected. Each student must pass a written and/or oral examination upon completion of course work. In addition to the core, Systems Ecology - Ecological Engineering requires courses in general and terrestrial ecology, estuarine systems and limnology, oceanography and meteorology, economics, ecological and general systems. It is recommended that courses be taken in hydrology, resource management, urban planning, water chemistry, and/or waste treatment.

Environmental resources management requires courses in water quality management, water management, fluid mechanics, and differential equations. Desirable, but not required, are water supply engineering, sewerage and wastewater treatment, and partial differential equations.

An Engineer degree is available for engineers who require additional knowledge beyond the master's degree. This degree requires forty-five units of graduate work beyond the master's degree, and it falls midway between the master's and the Ph.D. in the amount of work required. This degree is not widely recognized, so its pursuit is not encouraged. An Engineer degree does not, in any way, suffice as partial fulfillment of doctoral requirements.

To be admitted to the Ph.D. program, one must have a master's degree. Once admitted, a three-person supervisory committee is appointed to guide the student's research and study program. A minimum of eight quarters in residence is required to complete the program. Very little course work is specified in order to allow the student and his/her committee the maximum flexibility in tailoring a program to the needs of the individual. With the committee's approval, a student may choose one or more minor fields, restricted only by the fact that the minor should unify relative to a clear objective. The Ph.D. candidate must demonstrate proficiency in a language other than his/her native tongue, or must complete a non-technical minor outside of the major field of interest, to be chosen by the supervisory committee. After all of the language requirement has been met, and substantially all of the course work is complete, a qualifying examination for candidacy status for the doctor's degree must be taken. The dissertation represents the culmination of the candidate's program, and following its defense the Ph.D. degree is awarded.

CURRENT FACULTY, STUDENTS, GRADUATES

The seventeen person faculty usually expends half of its efforts on teaching and half on research, with the exception of the three full-time instructors.

Enrollment in the graduate program in Environmental Engineering Sciences peaked in 1973 with 125 students. There are now 103 people enrolled, fifteen of whom are doctoral students. Fourteen research contracts supply financial assistance for graduate students in this program. The enrollment is declining because financial assistance for graduate students is severely limited at the present time.

During 1977, a total of thirty-two graduate degrees were conferred in this department. There were four recipients of the M.E., twenty-two of the M.S., and six of the Ph.D. The Engineer degree has not yet been awarded. It is not determined how many of these degrees are specific to either of the two concentrations.

A follow-up study of graduates between 1971 and 1973 shows that of 133 people who earned master's degrees, twenty-five were employed by consulting firms (primarily M.E. graduates), fourteen were hired by industry, nineteen pursued additional degrees, thirteen went to work with health departments, nine accepted positions with the U.S. Environmental Protection Agency and the U.S. Public Health Service, fourteen are working with other governmental agencies, and six are teaching in colleges or universities.

PROGRAM PROJECTIONS

The future of this and other similar environmental programs is keenly dependent upon the quality and quantity of assistance and support which is received. It has already experienced a reduction in enrollment because of training fund cuts. It is anticipated that the demand for graduates such as these will be great as our environmental situation grows increasingly complex. During recent years, there have been many more positions available for environmentalists than there are properly qualified specialists to fill them.

Because of the withdrawal of federal support for graduate education, competition for financial aid will become increasingly intense. It is felt, however, that as students forget that federal training money existed in the past, the enrollment trend will stabilize or increase gradually.

COURSE DESCRIPTION

ENV 520 Environmental Biology - Basic cellular organizations and processes related to waste treatment. Role of environmental engineering in maintaining stability of fresh water, marine and terrestrial ecosystems. (4 q.h.)

ENV 611 Water Quality Management - Water quality management applied to streams, lakes and tidal estuaries and embayments. Influence and effects of municipal and industrial wastes on public water supplies, shellfish, storage, recreational uses, industrial uses, and wildlife. (4 q.h.)

ENV 612 Water Management Seminar - Emerging problems and control of water in the environment. Needs for new and better technology and institutional arrangements for management of water. May be repeated with change in content up to a maximum of 9 credits. (0-5 q.h.)

ENV 613 Environmental Resource Systems - Standards and criteria for evaluation of environmental resource projects. Formulation of mathematical models of environmental problems. Application of systems engineering and operations research as aids in decision-making. (4 q.h.)

ENV 616 Urban Environmental Problems - Examination of overall problem of developing and maintaining high quality physical environment in urban areas. Systems analysis approach to air, and water quality management problems will be discussed. (4 q.h.)

ENV 617 Estuarine Systems - Coastal systems, their components, processes. Systems models, and management including tropical, arctic, and man-affected types, field trip, and literature review. (4 q.h.)

ENV 630 Environmental Chemistry - Water treatment, chemical composition of natural waters and other phases of environmental chemistry. Applications of physical and organic chemistry of aqueous and gaseous systems. (1-5 q.h.)

ENV 670 Graduate Environmental Engineering Seminar - (0-2 q.h.)

ENV 671 Special Problems in Environmental Engineering - May be repeated with change in content up to maximum of 12 credits. (1-5 q.h.)

EGC 621 Surface Hydrology - Mechanics of the occurrence and distribution of water by natural processes including the global energy balance, geophysical fluid motions, precipitation, run-off, infiltration, and water losses. Catchment characteristics and hydrograph analysis. (4 q.h.)

EGC 622 Operation Hydrology I - Frequency analysis of hydrologic events. Hydrologic probability distributions. Analysis and synthesis of hydrologic data. Linear and nonlinear regression. Multivariate analysis of hydrologic signals. (4 q.h.)

EGC 623 Operational Hydrology II - Correlation and spectral analysis of hydrologic systems and signals. Application of linear systems theory to components of hydrologic cycle and total rainfall-runoff process. Criteria for hydrologic instruments and networks. (4 q.h.)

INSTITUTION: UNIVERSITY OF KANSAS

PROGRAM: Environmental Studies

DEPARTMENT: Interdisciplinary Program

DEGREE: B.A. in Environmental Studies
B.A. in General Studies with Environmental Studies Majors

CONTACT: Dr. Kenneth Armitage, Director
Environmental Studies Program
Snow Hall
University of Kansas
Lawrence, Kansas 66045
(913) 864-2700

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The Environmental Studies program provides an interdisciplinary major for persons desiring a fundamental knowledge of the nature of basic environmental parameters, a sense of dimension of man's impact on those parameters, and a basis for approaching solutions to problems resulting from this impact. This program allows a student to intensify investigation in particular areas as diverse as anthropology, biology, chemistry, economics, engineering, and education. Depending on the particular goals of the student, a program may be designed which includes general coverage of an area or which includes intensive training in a specific subdiscipline. The environmental studies core is available as background to a professional degree or as a supplement or emphasis to programs in other departments.

The interdisciplinary nature of this program gives the undergraduate access to a wide spectrum of university facilities housed in departments that contribute faculty and resources to the Environmental Studies program. The University of Kansas maintains a 500+ acre experimental ecology reserve which includes a series of ponds providing an aquatic environment for pesticide, water pollution, and soil treatment research. Other facilities on the Lawrence campus include an Institute for Social and Environmental Studies, Kansas Geological Survey, Water Resources Institute (with Kansas State University), Environmental Health Laboratory, Remote Sensing Laboratory, and Air Pollution Laboratory. Field work courses and seminars on selected topics (air and water pollution, remote sensing, etc.) provide some practical experience for undergraduates.

No research funding is available to the program as such although faculty members teaching Environmental Studies courses may apply for monies for individual research.

PROGRAM REQUIREMENTS

The Environmental Studies major program consists of 31-34 hours of preparatory courses in environmental studies and related courses, plus three or more elective courses in an area of specialization. Each student is assigned to three advisors--two of these advisors are to be members of the College Environmental Studies Committee and the third is to be selected by the student from faculty in a chosen area of concentration.

CURRENT FACULTY, STUDENTS, GRADUATES

Approximately forty professors contribute to the Environmental Studies program at the University of Kansas. According to university guidelines, faculty time is divided among teaching (40-45 percent), research (40-45 percent), and service responsibilities. Officially one faculty member teaches in the program although his line is split equally between the botany department and the systematics and ecology department. The program is administered by a faculty member on release part-time from another department. Environmental Studies does have its own budget within the university.

Enrollment statistics are difficult to generate because students at the University of Kansas do not declare a major until the junior year. The program is currently at maximum capacity level with approximately 225 students per semester taking Environmental Studies courses. The fifty-five juniors and seniors in the program are encouraged to take a second major to better their chances on the job market. Graduates have been placed at the State Health Department (air and water pollution labs) and in engineering firms and an estimated 10 percent seek further schooling beyond the B.A. level. Faculty perceptions are that students find employment, but the placement distribution in the private vs. public sector is not known. Requirements for occupational advancement beyond a certain level (e.g., an engineering degree) are obstacles for Environmental Studies graduates. Financial support offered students is administered by the university and is regarded as good but unable to meet the demand.

PROGRAM PROJECTIONS

Increased student demands for in-depth technical orientation or in-depth social science orientation have brought the program to a critical stage. The faculty would like to develop both options without losing a liberal arts concentration and so provide students with a more usable degree. There is some concern that the program as it currently exists may not adequately prepare persons for more rigorous environmental graduate work. Further development of the preprofessional option will require financial support from the university and increased time commitments from other faculty (e.g., law, economics, geology, geography). Other curricular plans call for coursework related to environmental impact statements.

COURSE DESCRIPTION

Core courses (all must be completed by majors)

Environmental studies: 148 Introduction to Environmental Studies- This course presents an overview of naturally evolving interactions within the environment and man's role in these interactions. Present problems are suggested and directions for the future are discussed. (3 s.h.)

332 Environmental Law - A study of the matter and the extent to which law might be used to combat environmental problems and to conserve natural resources. (3 s.h.)

342 Seminar in Environmental Studies - Discussion of current topics in environmental problems. Topic area varies from semester to semester. Individual or group research projects required. (1-3 s.h.)

360 Field Work in Environmental Studies - This course is designed to provide practical experience in the scientific measurement of environmental parameters. It is recommended that students entering this course have some experience in laboratory techniques in chemistry and a strong background in the environmental studies core courses. (4 s.h.)

Biology: 414 Community and Ecosystem Ecology - Study of factors limiting distribution of organisms, energy flow in ecosystems, community structures, biogeochemical cycles, and functional analysis of ecosystems. (2 s.h.)

Geography: 333 Environment and Man - Specifically dealing with human-environmental relationships and problems. This course will focus on basic geographical concepts of environmental problems. (3 s.h.)

324 Environmental Geology - An introductory course in the fundamentals and scope of environmental geology. Lecture and discussion periods cover topics of air and water pollution, radioactive and solid waste disposal, resource conservation, geologic hazards, land-use planning, construction engineering, and environmental health. Special emphasis is given to interactions

between geology and architecture, economics, engineering, geography, law, and political science. (3 s.h.)

328 Geophysics and Geochemistry of Pollution Systems - Course will treat atmospheric and water pollution systems both on global and local scales. Also includes review of chemical and physical sensing techniques. Specific references will be made to influences of local geophysical and geochemical factors upon pollutants. (3 s.h.)

Other environmental courses

Architecture and Urban Design: 720 Energy and the Environment- The architectural and planning implications of the nature of energy, energy flux in the biosphere and the interfaces between energy and man, are considered in depth in this course. (3 s.h.)

774 Planning and Natural Environment - Review of conservation and ecological considerations in planning (Geddes, McKaye, Wright, Hillberseimer, Cranston, McHarg, et al.); land use relationships to water, air, solid waste, noise, pollutions; emphasis on developing research applications to land use environmental quality relationships. (3 s.h.)

Civil Engineering: 455 Hydrology - A study of the use of rainfall data and river discharge measurements in the solution of problems relating to flood control, irrigation, drainage, waterpower development, water supplies, and storm sewers. (3 s.h.)

477 Environmental Pollution Control - The application of basic science fundamentals to natural systems of air, water, and land. Application of these fundamentals to protect the environment through the use of pollution abatement processes. (3 s.h.)

750 Water Resources Policy and Administration - An examination of the sociopolitical, economic, and engineering significance of institutional arrangements affecting American water resources policy, and the application of basic concepts of engineering, hydrology, economic projections, and water law to current problems of water resources planning and policy formulation. (3-5 s.h.)

751 Applied Hydrology - The application of various empirical, statistical, and synthetic design techniques to the solution of applied problems in engineering hydrology. (3 s.h.)

770 Sanitary Chemistry I - Lectures on the application of the fundamentals of aquatic chemistry to water purification and wastewater treatment. (2 s.h.)

773 Applied Water Microbiology - A basic study of the microorganisms of importance in sanitary engineering, namely, bacteria, fungi, algae, viruses, protozoa, rotifers, and crustaceans. Emphasis is placed on the reactions produced in dilute nutrient

773 (cont'd) - solutions and in mixed microbial systems as occur in natural water and wastes. (4 s.h.)

775 Marine Pollution - Marine chemistry and relations to pollution problems. Types of pollution and effects on the environment. Interrelation of the chemical, physical, geological, and biological parameters of the ocean and their interaction with pollutants. Special emphasis on problems of worldwide occurrence, international law, cooperation, and economics. (3 s.h.)

Economics: 505 The Economics of Social and Environmental Problems - A study of the economic factors related to such social and environmental problems as poverty, health, education, pollution, and population growth. (3 s.h.)

610 Resource Economics - Analysis of the economic relationships between natural resources, population, and environment. The economic problems and consequences of replenishable and nonreplenishable natural resources and of sole ownership and common ownership. Emphasis on allocation over time, externalities, and public goods and public policy in terms of centralized and decentralized decision processes. (3 s.h.)

Geography-Meteorology: 525 Air Pollution Meteorology - A study of background levels and concentrated sources of atmospheric pollution together with considerations of pollution build-up in urban areas as related to particular weather conditions. Inadvertent weather modifications and effects of atmospheric pollution of particular weather events and general climate will be discussed. (3 s.h.)

Human Development: 269 A Behavioral Approach to Environmental Protection - The course features a series of practical exercises designed to minimize the individual's adverse effect on the environment. Each exercise includes background information, measurement techniques, tactics for change, and evaluation strategies for a specific area of environmental abuse. Exercises are designed to be conducted outside of class with class time devoted to problem solving and data analysis. (4 s.h.)

Journalism: 656 Science Writing for the Media - Concentrated study and intensive writing so that students may learn to gather and write the news of medicine, science, and technology and make that news understandable to a mass audience. (2 s.h.)

Physics: 301 Environmental Physics - Applications of elementary physics to the interaction of society with nature. Emphasis will be given to the development of quantitative calculations based on mechanics, thermodynamics, and electricity. Possible topics include, but are not limited to: production; circulation; natural and artificial radioactivity; structure and properties of solids. (3 s.h.)

INSTITUTION: UNIVERSITY OF MICHIGAN

PROGRAM: Environmental Education

DEPARTMENT: School of Natural Resources

DEGREE: Bachelor of Science (B.S.)
Master of Science (M.S.)
Doctor of Philosophy (Ph.D.)

CONTACT: Dr. William B. Stapp, Chairman
Environmental Education and Outdoor Recreation
Room 2006, Dana Building
School of Natural Resources
University of Michigan
Ann Arbor, Michigan 48109
(313) 764-1410

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The goal of environmental education, according to a current University of Michigan bulletin, "is to produce citizens who are environmentally effective and who can help others become environmentally effective--through teaching, mass communication, community organizing, or some other strategy or combination of strategies." With this objective, the Environmental Education program, housed in the School of Natural Resources, offers three major curriculum options to undergraduates and graduate students:

(1) Environmental Instruction--"stress on developing, implementing, and evaluating environmental curricula for primary and secondary schools, and for other education-related organizations" and "designed for students who want to improve the environment by helping young people clarify their environmental values and obtain new environmental knowledge and skills"

(2) Environmental Communication--"stresses mass audiences, and the use of communications media for environmental persuasion and planned attitude change" and "designed for students who want to improve the environment by convincing others to interact with the environment in new ways"

(3) Environmental Advocacy--"emphasizes the relationship between environmental quality and social justice, and how to change political institutions through interest-group activism" and "designed for students who want to improve the environment by organizing interest groups to fight for their environmental needs"

Approximately 70 undergraduates specialize in one of the Environmental Education options in the School of Natural Resources. Coursework leading to a teaching certificate is available. The master's degree is designed "to help students become practicing environmental educators", while the doctoral program "is designed to train scholars, researchers, and college teachers, rather than pratitioners, in the areas of environmental instruction, communication, and advocacy."

Job opportunities for the B.S. and M.S. students in the instruction option include work in school systems, government agencies in education and natural resources, and private organizations. Doctoral graduates may entertain these same employment possibilities as well as college or university teaching. The post-graduation possibilities for the communication and advocacy options are also varied. "Communication students may find employment as environmental specialists for mass communication industries, as information specialists for environment related government agencies, or a public relations specialists for corporations or non-profit environmental groups." Jobs for the advocacy students may lie within "established institutions such as corporations and government agencies, or with neighborhood organizations or emerging coalitions on the local, state, regional, national, or international level."

Given the emphasis of the program on the examination of environmental issues from social, economic, ecological, and political vantage points, students are not surprisingly engaged in "'real-world' work-study experiences as instructors, communicators, or advocates." Students are also involved in writing grant proposals and implementing them. The program recently received a $60,000 grant from the Department of Health, Education, and Welfare to sponsor a national conference on environmental education issues and a $80,000 SEA Grant to produce curricular material on the Great Lakes for junior high school students. Numerous workshops and seminars for the general public, youth leaders, lawyers, architects, planners, and community groups provide practical training for students and professional improvement for faculty.

PROGRAM REQUIREMENTS

Undergraduates build a solid program by taking half of their hours in the humanities and physical, social, and biological sciences, and the other half divided between courses in Natural Resources and electives. Master's degree candidates must have or acquire a basic foundation (one course each) in ecology, economics, political science, behavioral science, and research methods. Those students entering the communication option should have considerable competence in at least one of three areas: communication skills, communication theory, or environmental sciences. Students in all three options must take the core course "Environmental Education and the Concept of Values" and a minimum of three courses in environmental sciences (e.g., resource and human ecology; resource and welfare economics; resource policy, management, and law). The thesis program requires 24 credit hours of courses and work-study, plus 6 hours of thesis; the non-thesis program calls for 36 credit hours of courses and work-study.

Doctoral candidates are officially "at-large" within the School of Natural Resources and not associated with any particular program. There are no established requirements for the Ph.D. at present; but typically students devote four semesters to coursework, submit a dissertation proposal and form a doctoral committee, pass preliminary examinations, write the dissertation, and defend it in three to four years. Admission criteria are similar to those for the master's degree.

CURRENT FACULTY, STUDENTS, GRADUATES

Four full-time faculty members in Environmental Education serve the 70 undergraduates in Natural Resources concentrating in this program and approximately thirty M.S. and eight Ph.D. candidates. Internships (e.g., with the Sea Grant Program) and teaching assistantships as well as standard university aid programs offer financial support to students.

Data on the average number of graduates annually indicate that roughly 25 B.S., 15-20 M.S., and 2 Ph.D. degrees are awarded yearly. A representative listing of job placements for these graduates shows that 27 percent enter government positions, 43 percent choose educational services and teaching, and 30 percent find employment in the private sector.

PROGRAM PROJECTIONS

The Environmental Education program at the University of Michigan operates on a continuing plan to identify, implement, and evaluate curriculum objectives. The current focus at the undergraduate level rests on provisions for new classes and behavioral studies in skill training and in mass media and the environment. Monies are needed for internships, laboratories, media equipment, and staffing to maintain the program. Faculty in resource ecology, management, and policy and outdoor recreation have recently been added or those lines are expected to be filled in the near future. Enrollment in the program should remain fairly stable given a firm commitment by the program administrators and faculty to maintain an optimal environment for student interaction with peers and staff. The emphasis is on quality, not quantity, in this program though its student numbers indicate a keen interest in the environmental education offerings. With changing public orientations to environmental concerns, employment prospects should remain high for program graduates.

COURSE DESCRIPTION

School of Natural Resources

Introductory courses:

NR 301 Ecological Issues - A nonlaboratory course incorporating ecological principles and concepts underlying the management

NR 301 (Con't) - and use of natural resources, with consideration of socio-economic factors and institutional roles. Throughout the course, emphasis is placed on the importance of interdisciplinary approaches to matters concerning the allocation of natural resources and the quality of our environment. (3-4 **s.h.)**

Natural Resource Ecology:

NR 243 Ecology of Lakes and Oceans/Zoology 243 - An introduction to organisms and communities and their interactions with the physical and chemical environment in the world's waters. General principles of ecology will be emphasized and environmental prolems will be critically analyzed. Topics will include pollution and eutrophication, coral reefs, sexual and asexual populations, life strategies, and the diversity of aquatic organisms. (4 s.h.)

NR 311 Perspectives in Ecology - An ecosystem approach, with emphasis on the functional aspects. The following principles and concepts are stressed: energy flow, biogeochemical cycling, productivity, populations and community dynamics. Three lectures, one laboratory weekly, and two weekend field trips. Intended for students who desire a scientific approach to ecological problems. (4 s.h.)

NR 410 Wildlife Ecology - The quality of stream environments; the regulatory influence of pollutants; the influence of environmental disturbance upon community stability, diversity, and other characteristics; the role of ecology in pollution regulation and control. (4 s.h.)

NR 411 Aquatic Ecology - The quality of stream environments; the regulatory influence of pollutants; the influence of environmental disturbance upon community stability, diversity, and other characteristics; the role of ecology in pollution regulation and control. (4 s.h.)

NR 412 Wetland Ecology - The structure and function of wetland ecosystems; their value, importance, and management. The physical, chemical, and biological aspects of local wetlands, with emphasis on the biology and adaptations of the organisms. Discussion of management goals, methods, and problems. Intended for natural resources science students who want to become familiar with the details of wetland ecosystems. (4 s.h.)

NR 413 Biophysical Ecology/Bot. 413 - Thermodynamics of plants and animals including energy exchange by radiation, convection, and evaporation. Chemical kinetics of photosynthesis and gas exchange processes are included. Basically an analytical description of the interaction of plants and animals with their environment. Particular emphasis is given to a discussion of radiation

NR 413 (Con't) - (including light), its quantum properties, spectral character, geometrical relations, and time dependence. A model of primary productivity is described. The climates in which animals must live as a result of their inherent thermodynamic properties are discussed. The fundamentals of ecology are analyzed in terms of sound biochemical and biophysical principles. (3 s.h.)

NR 504 Problems in Ecology - Energy transfer, nutrient cycling, natural selection, problems of distribution and abundance, community parameters, and concepts of ecosystem analysis. This course is designed for graduate students with no prior training in biology. (3 s.h.)

Animal and Aquatic Sciences:

NR 419 Biological Control-Integrated Control of Insects - Fundamental principles of biological and integrated control of insects. This includes predators, parasites, diseases, pest resistance, pheromones, physical and mechanical controls, etc. Effect of insecticides on biological control systems. Current examples in pest management. (3 s.h.)

NR 424 Physiological-Ecology of Fishes - Lecture and seminar discussions on functional morphology, physiology, and behavior of fishes with special emphasis on bio-energetics. Selected key interface between a fish and its habitat will be emphasized in relation to their value in assessing sub-lethal pollutant stress. (3 s.h.)

Plant and Soil Sciences:

NR 331 Silviculture - Applications of ecological principles in controlling forest establishment, composition and growth for purposes of managing land for consumptive and non-consumptive goods and services. (3 s.h.)

NR 333 Soil Environment/Bot. 333 I - Consideration of soils as components of natural and man-modified ecosystems. Physical, chemical, and biological properties of soils as they relate to root and plant growth, ecosystem function and land use. (3 s.h.)

NR 432 Forest Hydrology - Principles and processes affecting the movement and disposition of water on forested land. Precipitation; streamflow, interception infiltration and soil water movement; evaporation and transpiration; erosion; snow hydrology; effects of forest practices on water yield and water quality. (2 s.h.)

Statistics, Measurements, and Modeling:

NR 442 Remote Sensing in Natural Resource Inventories - Directed applications of remote sensing techniques in natural resource inventories. Emphasis is placed upon developing usable skills to meet information needs of resource managers and planners. (1,2,3 s.h.)

NR 641 Research Methods in Behavior and Environment - Fundamentals of research methods with an emphasis on alternative strategies, experimental design, problems of measurement, issues pertaining to validity, and ethical implications. These will be applied to a variety of problem areas at the people/environment interface, incorporation the research interests of the participating students. The course is best suited to graduate students who are in some phase of doing their own research. (3 s.h.)

Management of Natural Resources:

NR 451 Wildlife Management - A study of basic management practices followed for forest, farm, and wetland wildlife. Techniques for collecting environmental and population data, their analysis and use in management. (4 s.h.)

Resource Policy, Administration, and Economics:

NR 365 Social Basis of Resource Policy - Social, economic, political factors in natural resource policy. Policy, planning, administration, and management in organization. Resource and environmental laws, programs, and agencies. Political and economic processes in resource policy formulation. Cases in forest, land use, water, waste management, urban, and other resource and environmental policy problems. (3 s.h.)

NR 465 Natural Resource and Environmental Policy II - Discusses the political history of American natural resources, the development of U.S natural resource and environmental policy, and current issues both within the U.S. and in a global context. Emphasis is on understanding current issues in their present as well as their historical context. (3 s.h.)

NR 470 Natural Resource Economics/Econ. 478 - After an initial review, economic principles are applied to problems of natural resource management, development, and policy. Specific natural resources are taken to illustrate the range of problems that may arise. Finally, the possibility of utilizing natural resources as an aid to economic development of less developed nations is discussed. (3 s.h.)

NR 472 Water Resource Economics - Economic issues in water resource planning, administration, development, and conservation. Efficiency versus equity considerations. National and regional development goals. Benefit-cost analysis and other evaluation techniques. Analysis of water demand. Economic issues of water pollution, recreation, and multiple-objective planning models and their application, and environmental quality. (3 s.h.)

NR 558 Water Resource Policy and Administration - Consideration of policy processes associated with development of water resource utilization. Special attention is given to the history and development of policy related to water quality. Identification of institutional problems associated with implementation of water policy in the federal-state-regional-local arena. (3 s.h.)

NR 559 Political Theory and Resource Allocation - Detailed investigation of a variety of political theory relevant to resource allocation problems. Consideration is given to the role of conflict, coalition formation, goal-attainment, and political interaction as elements of the generalized reserve allocation problem. Students will utilize case study situations through utilization of computer simulation techniques. (3 s.h.)

NR 562 Foundations of Resource Policy Making - Students are introduced to basic theoretical concepts in resource policy making and administration. These are applied in analyses and evaluations of alternative governmental strategies for regulating resource use. Case studies of water, air and land resource problems are considered. (3 s.h.)

NR 564 Environmental Policy and Federal Development Programs - Behavior of administrative organizations and administrators whose actions affect environmental resources; factors influencing administrative behavior and decision-making, and strategies for achieving administrative change; incorporation of environmental protection objectives into administrative planning and decision-making processes. (3 s.h.)

NR 568 Economic Analysis of Natural Resource Problems - Resource and environmental issues are studies with the aid of specific elements of economic analysis. Topics are drawn from a wide range of areas such as pollution (welfare theory and externalities, subsidies, taxes, standards); recreation and wilderness (willingness to pay, irreplacibility, congestion); fisheries (common property, eumetric fishing); forestry (denied demand, joint product, capital theory); water (cost/benefit analysis, pricing); stock resources (exhaustibility, user cost, royalities, cartels); and development (trade, linkages, choice of technology). (3 s.h.)

NR 576 Legal Aspects of Resource Policy and Management - Introduction to legal aspects of natural resource policy and management, and to key statutes in this field. (3 s.h.)

NR 865 Legal Aspects of Environmental Quality/Law 731 - Selected problems in maintaining environmental quality, with particular emphasis on the role of private citizens and organizations in using legal processes. Escalation of park land prices, and consideration of devices for control; pesticides; water pollution control; aesthetic considerations in licensing power projects. (2 s.h.)

Behavioral and Communication Sciences:

NR 280 Methods of Natural History Interpretation I - A study of interpretive master planning. On-site interpretive techniques, including visitor orientation, roadside exhibits, nature trails, slide-illustrated lectures and visitor centers. Off-site interpretive procedures, including mass-media, publications, regional museums, and radio and TV programs. (3 s.h.)

NR 360 Social and Environmental Change I - This course addresses environmental problems and their relation to institutionalized social problems. It reviews and analyzes various theories and programs for socio-environmental change. This includes review of concrete issues and problems in defining the understanding groups involved in socio-environmental change. Issues will be related to students own background, values and goals. (2 s.h.)

NR 376 Mass Media and the Environment - This course analyzes the environmental content of the mass media, in terms of its origins in media structure and processes, and its impact on audience behavior. Through readings, discussions, and examinations, students will evaluate the media as tools of mass environmental education, and suggest ways of improving media performance. (3 s.h.)

NR 480 Community Environmental Field Studies I - A course designed to study under field conditions certain environmental issues that are common to most community environments, such as land utilization, recreation, air and water pollution, transportation, housing, and environmental planning. Each issue will be examined from an ecological, economic, political, social and technological point of view. (3 s.h.)

NR 481 Environmental Education Seminar/Educ. D474 II - To provide a conceptual and philosophical understanding of the emerging field of environmental education with special emphasis on the following: the role of the teacher in creating a learning environment, values, and teaching, attitude formation and change, handling controversial issues, principles of curriculum development, available instructional aids and techniques in utilizing them, school site planning and

NR 481 (Con't) - and utilization, and strategy for developing and implementing environmental education programs. (2 s.h.)

NR 483 Planned Social Change and Environmental Problems - Emphasis is on concepts for understanding social system change, major strategic perspectives on planned social change in the U.S., and problems in planned change. Approaches to planned change are related to environmental problems as one aspect of a complex of interrelated social problems. Tactical issues are introduced. Case studies are used for explanatory purposes and for application of learnings. (3 s.h.)

NR 485 The Environment and the Citizen (Part I) I,II,III - An analysis of selected current environmental community problems with emphasis on developing citizen knowledge about these problems and possible solutions. This is an independent study course taught through The University of Michigan Extension Service, in cooperation with the School of Natural Resources. (2 s.h.)

NR 581 Advanced Seminar in Environmental Education - A seminar on current topics relating to environmental education instructional programs, such as: emerging philosophies, conceptualizing, designing, implementing, and evaluating programs; constraints to program implementation, and current research findings. A course designed primarily for advanced graduate sutdents focusing their training on environmental education instructional programs. (2 s.h.)

NR 609 Dynamics of Interest Group Change - The dynamics of professional and political dilemmas, power and conflict utilization, diagnosis and change agentry accountability, small group dynamics and change-agent-roles and maintenance functions and the critique and analysis of several social and environmental change models. Students are expected to engage in small group discussions, micro role plays and simulation exercises and the critique and presentation of oral and written reports. (2 s.h.)

NR 676 Mass Media and the Environment - This course analyzes the environmental content of the mass media in terms of its origins in media structure and processes, and its impact on audience behavior. Through readings, discussions, and independent empirical research, students will evaluate the media as tools of mass environmental education, and will suggest ways of improving media performance. (3 s:h.)

INSTITUTION: UNIVERSITY OF PITTSBURGH

PROGRAM: Environmental Systems Engineering
DEPARTMENT: School of Engineering (interdisciplinary)
DEGREE: degrees granted by engineering departments

CONTACT:
Dr. Patrick J. Athol, Director
Program in Environmental Systems Engineering
University of Pittsburgh
1140 Benedum Hall
Pittsburgh, Pennsylvania 15261
(412) 624-5269

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

Established by the School of Engineering in 1969, the interdisciplinary Environmental Systems Engineering Program was developed in response to needs for broad engineering approaches to societal problems and the design of solutions for these problems. The program is supported by a grant from the late Lt. General R.K. Mellon and his wife. An interdisciplinary faculty from engineering, the social, and the planning sciences teach the program's courses. Students first enroll in one of the School's six engineering departments, and an interdisciplinary-oriented program may be designed with the advice and approval of the faculty advisor. Graduate students are expected to participate in the program's research projects as partial fulfillment of the graduate degree requirements of the student's major department.

Recent graduates have obtained positions requiring a mixture of skills in the fields of transportation, planning, and environmental systems in federal agencies such as the U.S. Environmental Protection Agency. Others have obtained redevelopment and city planning jobs with municipalities. Most have obtained positions with either consulting firms or federal, state, city, or county agencies.

The Environmental Systems Laboratory is a problem definition and technology transfer facility providing facilities necessary to environmental and urban systems design and analysis. Computer simulation and information system capabilities, special collections of data and research reports, and student research space are provided. Laboratory - graduate study and research opportunities are offered which are oriented toward equipping students for career positions in research, management, design and planning, technology and science, policy formulation, and public policy analysis. Transportation, resource quality, design and planning, environmental policy, and

and social-technological systems analysis are offered as areas of specialization for study by graduate students.

PROGRAM REQUIREMENTS

In order to enter this program, prospective applicants are required to take a variety of mathematical courses in order to possess a common analytical framework for study and research. Differential equations, basic statistics, multi-varied statistics, operations research and systems analyses courses are recommended to have been taken prior to making application to enter the program.

Undergraduate courses offered by the program deal with environmental problems, design of solutions and the technical, private, political and other contexts within which solutions are implemented. During the undergraduate student's junior year, two core courses - Civil Engineering 163, Environmental and Urban Systems Analyses, and Civil Engineering 165, Environmental Systems Laboratory are usually taken. Students from any department may design program in their major engineering area with an environmental orientation. Senior year students select courses expanded or developed in specialty areas related to environmental problems. Requirements for the Bachelor of Science degree vary among the departments in the School of Engineering.

The two graduate program core courses. Environmental System Engineering 263 and 265, provide a broad knowledge of analyses, synthesis and control problems. Students specialize in one or more closely related fields in addition to the core sequence. Graduate students also includ supporting work appropriate to the problem definition and analyses within the environmental systems area. Courses involving statistical analysis, optimization and systems analysis, and work relative to societal problem recognition and evaluation must be included.

Financial assistance available to graduate students in the program includes research assistantships, teaching assistantships, and a small amount of co-sponsored support.

CURRENT FACULTY, STUDENTS, GRADUATES

Seven faculty members, none full-time, contribute to the teaching of the programs curriculum. Each one normally teaches two courses and spends about one-half of his or her time in research. Research funding is available from the Energy, Research, and Development Administration (now part of U.S. Department of Energy) and the U.S. Department of Transportation (Federal Highway Administration) for simulation studies in the future role of automobiles.

Twelve full-time students (one female) are enrolled in the program. Two-thirds continue on for Ph.D.s in the program as most first enter the M.S. program and change topics when they decide to go on for doctorates. It is estimated that annually two students receive M.S. degrees and two receive Ph.D.s.

- Few graduates continue on to other schools for additional degrees although one recent graduate continued on for a doctorate in transportation offered by the Massachusetts Institute of Technology. Virtually all graduates find employment in their field and it is estimated that fifteen percent find private sector jobs (mostly consulting), 60 percent government, and fifteen percent find positions within academia.

PROGRAM PROJECTIONS

The Environmental Systems Engineering Program may undergo a restatement of purpose, but will not affect any structural changes in the foreseeable future. Two additional faculty members may be recruited and one is likely to be a mathematical programmer with operations research expertise and the other may be a large-scale economist with economics of energy systems interests. The faculty may increase by 50 percent with a corresponding increase of students, but it is not anticipated that there will be further growth beyond that level.

COURSE DESCRIPTION

(the following is a partial listing of courses)

261 Society and Environment (3 cr.) The ecosphere and man's impact upon it.

263 Analysis and Design of Environmental Systems (3 cr.) The methodology and techniques of systems analysis as they apply to the planning of social/technological/environmental systems, including the basic quantitative techniques; and project evaluation, planning and systems modeling.

265 Environmental Systems Laboratory (3 cr.) Case studies using the facilities available in the ESE laboratory, including the hardware, and the application and use of available software.

268 Seminar in Environmental Systems (3 cr.) Visiting lecturers lead discussions in the areas of environmental planning, resource management, environmental impact and government administration.

365 Urban Demography (3 cr.) The theoretical and analytical aspects associated with the three primary demographic processes: fertility, mortality and migration.

366 Policy Analysis (3 cr.) This course is designed to acquaint the student with the principal methods recognized in the field of policy analysis, or the policy sciences, and familiarize the student with the roles the analyst can play in public and private sector policy making.

INSTITUTION: UNIVERSITY OF WASHINGTON

PROGRAM: Environmental Studies

DEPARTMENT: Institute for Environmental Studies

DEGREE: Bachelor of Arts (B.A.) or Bachelor of Science (B.S.) in general and interdisciplinary studies - Environmental Studies

CONTACT: Dr. Gordon H. Orians
Director, Institute for Environmental Studies
University of Washington
Seattle, Washington 98195
(206) 543-1812

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The Institute for Environmental Studies is an inter-college and interdisciplinary educational unit which is university-wide in research and instructional scope. The Institute was established in 1972, and engages in a broad range of teaching, research and public service activities in environmental studies.

Three major types of research are conducted through the Institute and the staff. These efforts include: assistance to individual researchers involved in environmental research; the development of interdisciplinary research teams for specific environmentally related projects; and, the coordination and linking of interdisciplinary research personnel from across the university.

This is a very new program, and until 1976 there were no actual graduate or undergraduate degrees offered through the Institute. Rather, the students designed an environmental program through general studies in the College of Arts and Sciences, in conjunction with an environmental studies advisor. Today, this GIS degree requires approval of the Institute through a rigerous set of courses and an internship. The programs involve no formalized minor.

PROGRAM REQUIREMENTS

To gain admission to the undergraduate program in environmental studies, the student must obtain one Institute of Environmental Studies faculty sponsor and a second advisor. The second advisor does not have to be from the Institute, but should be selected from one of the departments which offers courses relevant to the student's major interdisciplinary interests.

Students must be accepted by the Institute's program at least two years prior to degree candidacy status. Students must also complete an internship or a special independent research project, and a senior level thesis. In order to be admitted and to be eligible for degree status, the student must maintain a minimum cumulative grade point average of 2.50.

Requirements for completion of the program include successful fulfillment of the University of Washington's general education requirements and at least three courses in each of the following areas: social sciences; biological sciences; math and statistics; physical sciences; and, professional studies. In accordance with the student's Institute advisor, environmental courses suitable to the area of interest totaling 50 quarter hours must be completed.

CURRENT FACULTY, STUDENTS, GRADUATES

The current faculty from the Institute directly involved with the program of studies includes two and one-half teaching personnel and three research persons. Of the total, two and one-half are cost-centered.

To date, there have been a total of 11 graduates from this program, and that figure includes several quarters in which students became eligible for degree candidacy. It is anticipated that graduates will number approximately 10 annually as the program becomes truly operationalized.

Of the 11 students, three are employed by private environmental consulting firms, two are in graduate schools, and three have entered public sector employment.

PROGRAM PROJECTIONS

Faculty from the Institute of Environmental Studies are hoping to strengthen the existing program prior to implementing any expansion plans. One Ph.D. instructor for environmental studies in the area of economics, will be added to the faculty during the next six months. This addition is necessary in order to alleviate the over burden of teaching responsibilities as presently delegated to the existing faculty.

COURSE DESCRIPTION

ENV S 101 Introduction to Environmental Studies - Introduction to the complexity of environmental problems, using current issues in environmental problems as the focus for discussions. (3 q.h.)

ENV S 204 Natural Processes in the Ecosystem - Survey of factors such as: climate, water, soil, geological processes, dynamics of plant and animal communities, and natural selection, as they affect the ecosystem. (5 q.h.)

ENV S 205 Social Sciences and the Environment - The significance of psychology, sociology, political science, anthropology and geography in increasing our awareness of how we perceive and interact with our environment. The course will focus on individual and group paradigms and how these affect environmental decisionmaking. (5 q.h.)

ENV S 206 Laboratory in Ecosystem Processes - Laboratory and field exercises on the role of climate, soils, geological processes and animal and plant population dynamics on the structure and functioning of ecosystems. Field trips to natural and human modified ecosystems, weekend field trips required. (3 q.h.)

ENV S 352 Environmental Impact Assessment - History, concept, methods, and practice of environmental impact assessment (EIA) are surveyed to provide a comprehensive understanding of environmental assessment. (3 q.h.)

ENV S 361 Environmental Values and Perceptions - Focus on the way individual and cultural values affect our perception of, and relation to, the environment. (5 q.h.)

ENV S 365 Workshop in Presenting Environmental Issues - Techniques for formulating and presenting informational programs on environmental issues. (3 q.h.)

ENV S 425 Environment, Population, and Food Production - Population growth and food production in relationship to climate, green revolution, energy, carrying capacity, and quality of life. (3 q.h.)

ENV S 432 Environmental Politics and Policy - Survey of the politics of environmental problem recognition, policy formulation, and implementation. (5 q.h.)

ENV S 433 Energy and Environmental Policy - Institutional, economic, and political implications of energy development, for society at large and for environmental values in particular. (5 q.h.)

ENV S 441 Economics of Environmental Management - Alternative economic policies for managing man's use of the environment. Economics of pollution and residual control, recreation, common pool resources, conservation of renewable and nonrenewable resources. (3 q.h.)

ENV S 451 Problems in Shoreline Management - Focus on various problems in shoreline management including economic uses, legal and administrative approaches to shoreline management, with particular reference to Washington's Shoreline Planning Processes. (3 q.h.)

ENV S 453 Practicum in Environmental Assessment - Undertakes preparation of model environmental impact assessment. Students from various departments form multidisciplinary teams to study in depth environmental problems and develop courses of action. (3-5 q.h.)

ENV S 481 Environmental Law - Legislative, administrative, and common law dealing with the environment. Introduces the student to the fundamental concepts and classic issues underlying the body of law and policy dealing with the environment. (3 q.h.)

ENV S 482 Land-Use Law - Introduction to the basic strands of land-use law; explores the constitutional and legislative background of laws controlling land use; develops an understanding of the legal strategies available to channel land development and the limits of these strategies. (3 q.h.)

ENV S 498 Special Topics in Environmental Studies - Topics varying from quarter to quarter. (1-5 q.h.)

ENV S 499 Undergraduate Research - Individual or team research of selected environmental topics. (var. q.h.)

ENV S 520 Seminar in Environmental Studies - Study and research in advanced topics of environmental studies, with focus on unpublished areas of research; conducted by visiting professors and Institute or department faculty. (1-3 q.h.)

ENV S 530 Scientists and Environmental Policy - Analysis of the contributions of scientists in the development and implementation of environmental policy. Emphasis on conceptualization of the policy "process" to understand ways in which scientists can (and cannot) enter into the formulation and application of public policy. Students should register concurrently in ENV S 531, Cases in Environmental Policy. (5 q.h.)

ENV S 531 Cases in Environmental Policy - Examples of development of scientific analyses and environmental policies. Students must register concurrently in ENV S 530, Scientists and Environmental Policy (2 q.h.)

ENV S 532 Internship Seminar - A post-internship seminar whose major focus is a detailed analytical paper concerning the role of science in analysis and decision-making in the agency or firm in which the student served as an intern. (3 q.h.)

ENV S 599 Special Topics in Environmental Studies - Research-level lectures, seminars, or discussions of topics of current interest in the area of environmental studies. Subject matter varies from quarter to quarter.

INSTITUTION: UNIVERSITY OF WISCONSIN - GREEN BAY (UWGB)

PROGRAM: Environmental Emphasis

DEPARTMENT: Interdisciplinary

DEGREE: Bachelor of Science (B.S.)
Bachelor of Art (B.A.)
Master of Environmental Arts and Sciences (M.E.A.S)

CONTACT: Dr. Martin H. Greenberg
Director of Graduate Studies
University of Wisconsin - Green Bay
Green Bay, Wisconsin 54302
(414) 465-2484

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

UWBG was founded in 1968 and operates on a 4-1-4 semester plan, with four-month semester from September to mid-December and February through May. January is set aside for special studies when individuals can focus attention on a particular project or subject, including work on campus, off campus or abroad.

Most undergraduate students select one of the 11 formally constructed concentrations as their majors. The concentration groups several subject areas together to study a problem of contemporary interest and concern. While the concentration intergrates several subject-matter areas to focus on solutions to one or more of the important problems facing people today, the discipline (co-major) provides depth of knowledge in a specific field.

The following is a schematic outline of the four colleges at UWGB, the concentrations found within those colleges and a list of suggested disciplines:

COLLEGE	CONCENTRATION*	DISCIPLINE**
College of Creative Communication	Communication-Action	Anthropology
	Humanism and Cultural Change	Biology
		Chemistry
		Chemistry-Physics
College of Community Sciences	Modernization Processes	Communication Processes
	Regional Analysis	Earth Science
	Urban Analysis	Economics

Schematic Outline (Cont'd)

COLLEGE	CONCENTRATION*	DISCIPLINE**
College of Human Biology	Growth and Development	Geography
		History
	Human Adaptability	Literature and Language
		Mathematics
	Nutritional Sciences	Medical Technology
	Population Dynamics	Music
		Philosophy
		Physics
College of Environmental Sciences	Science	Political Science
	Environmental Change	Psychology
		Sociology
		Theater
		Visual Arts

*Requires 30 hours of junior-senior level courses providing necessary interdisciplinary, problem-solving focus

**Provides depth of knowledge in a specific field; requires 36 junior-senior level courses--24 in discipline and 12 in concentration

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Professional education (business, teaching, environmental administration, leisure sciences, social services) is also available. Preprofessional Programs include: Agriculture Science, Architecture, City Planning and Community Development, College and University Teaching, Engineering, Health Professions, Home Economics, Law, Theology, and Water Resources and Hydrology.

M.E.A.S. degrees are available in Environmental Administration, Environmental Management, Waste Management and Resource Recovery, and Global Ecology.

The Environmental Administration goal is to assist governmental and non-governmental career professionals (and prospective professionals) to meet the complex demands of high-level organizational positions in the field of environmental planning and management. It began in 1973.

The Environmental Management program is developed with a broad understanding of and involvement in the problems of environmental management facing society in the context of problem identification analysis, alternative solution formulation and decision making.

Global Ecology is designed for students with a strong science background and an orientation to ecology who are interested in studying critical environmental problems from a global perspective. The program embraces three theme areas: Ecosystem Productivity, Community Health, and Environmental Quality. The theme in Environmental Quality provides a framework for dealing with issues related to water and air quality.

Waste Management and Resource Recovery has been developed in response to the need to manage wastes in ways that minimize environmental deterioration and use resources more effectively. The Global Ecology and Waste Management and Resource Recovery "tracks" were new in 1977.

PROGRAM REQUIREMENTS

Freshman admission requirements are:

1) be graduated from a recognized high school or equivalent;
2) rank in upper half of graduating class;
3) present 16 units of high school preparation: English (3 units), Mathematics (1 unit), Science (1 unit), Social Studies (1 unit), academic electives (6 units).

A B.S. or B.A. requires 124 credit hours.

University Seminars constitute a core program for the undergraduate. Each student chooses a variety of learning experiences which relate classic and modern notions of values to contemporary problems and continuing human concerns. Seminars are an 18 credit required program.

As a freshman, the student chooses four seven-week modules from a list of topics. During the sophomore-junior years the student has the opportunity to become usefully involved in the community and in other cultures. At the senior level, and after a great deal of learning experience within one of the concentrations, the student has a chance to integrate his/her knowledge and experiences with those of students from other concentrations.

An undergraduate major in public and environmental administration requires approximately 48 credits and a minor, 18 credits.

On the Masters level, each student writes his/her own program and completes it with the guidance of a committee. Depending on the "track" chosen, the required number of credits varies between 30 and 36.

Minimum requirements for entry into the graduate degree programs are a baccalaureate degree and a 3.0/4.0 grade point in the major field of study.

CURRENT FACULTY, STUDENTS, GRADUATES

Presently UWGB has a $161,000, 3-year NSF grant for Research Initiation and Support in Waste Management and Resource Recovery. Other grants are concerned with sewage sludge, water quality impact and recreation use, recovery of waste energy, and cement dust.

College work-study is one of a variety of financial opportunities available for undergraduate students. Teaching assistantships are available for graduate students.

PROGRAM PROJECTIONS

Because of the newness of the Master's programs, only speculation is possible.

ADDITIONAL INFORMATION

Laboratory and other facilities include a 1,200 gallon anaerobic digester, green house, growth chambers, total carbon analyser, atomic absorption spectroscopy, gas and liquid chromatography, X-ray emission spectroscopy, and other items of modern equipment for biological and chemical analyses.

UWGB's nature conservancy field stations in Brown County and the Door County Peninsula are used by faculty and students for environmental studies.

COURSE DESCRIPTION (a partial listing)

Undergraduate:

Communication-Action: 242-401 Designing the Environment I - Faculty and students from Urban Analysis, Regional Analysis, Science and Environmental Change, and Communication-Action investigate the environment as a prime relationship between the human organism and physical and mental context that surround it, as well as principles of design and the design process as it relates to planning human environments. Major topical areas include philosophy and poetry of space; perception of space; physical and psychological human health and effects of space on the physical well-being of the organism; design and construction of space. (3 s.h.)

Earth Science: 296-202 The Earth's Physical Environment - The materials and processes that have determined and are now modifying the physical features of the earth's environment are described and analyzed. (4 s.h.)

Education: 302-407 Developing Environmental Education Materials for the Schools - Developing instructional materials and strategies to integrate environmental concepts, problem identification, and problem solving strategies into elementary and secondary programs. A variety of environmental education materials and methods are considered. Emphasis on designing, using, and evaluating instructional materials for children--with children and their teachers in schools. (2-3 s.h.)

Environmental Administration: 350-301 Environmental Administration - Social, economic, and geophysical origins of changing environmental quality; major kinds of environmental problems and the impacts of environmental quality on human health and well-being. Principal institutional, organizational, and public policy approaches to solution of environmental problems, including decision sequences and information systems required for rational environmental management operations. Develops skill in use of methods and models for public and environmental decision-making. (3 s.h.)

Growth and Development: 426-438 Lifetime Needs and Environmental Planning - Problems in providing optimal development opportunities for persons of all ages in a complex democratic society. Human needs requiring community collaboration; effective procedures for implementing need-oriented programs; developing humane institutions and supporting services; the organization of the physical and social environments for optimal human development. (3 s.h.)

Human Adaptability: 478-201 Adaptation to the Environment - The morphological and functional adaptations of animals to the aquatic, aerial, and terrestrial environments and a consideration of human adaptability to the stresses brought about by technology and crowding. (3 s.h.)

Humanism and Cultural Change: 485-313 Man, Machines, and the Environment - The environmental effects of our attempts to exploit resources and to alter our surroundings throughout time. Ecological crises are put into historical perspective through the treatment of themes such as deforestation from prehistoric times until the present; the growth of air pollution with the adoption of fossil fuels; the effects of warfare upon the environment; the ecological effects of the industrial revolution; urbanization in response to agriculture and to industry.

Managerial Systems: 575-202 Business and Its Environment - The major components of the business enterprise and its environments of resources, competition, and regulation are studied by participation in a simulated world of competitive manufacturers who attempt to accomplish appropriate business goals. Pricing, profit, finance planning, controls, ethics, environmental impact, social responsibility, and other important concepts. Emphasis on issues that tend to enlarge the students' awareness of environmental issues that challenge the business leader. (3 s.h.)

Modernization Process: 662-400 Environmental Law - A synthesis of the fragmented collection of court decisions on the federal, state, and local levels, and examination of various legislative statutes and administrative codes which touch upon aspects of the physical environments. Attention to decisions of administrative units (AEC, Forest Service, National Park Service, etc.), problems of legal jurisdiction (including procedural questions), and substantive determinations by the courts. (3 s.h.)

Regional Analysis: 834-356 Environmental Impact Analysis - Procedural requirements of NEPA; State NEPA equivalents; methodologies of and approaches to environmental impact analysis; assessment of alternatives; interdisciplinary exposure to substantive types of impacts using natural and social sciences; emphasis on social impact analysis; local field project in impact analysis. (3 s.h.)

Science and Environmental Change: 862-422 Environmental Biogeochemistry - Microbial and chemical transformations of carbon, nitrogen, phosphorus, sulfur, and certain trace compounds in soil-water-atmosphere systems; fate of selected pesticides, fertilizers, natural and synthetic wastes in the ecosystem; beneficial and toxic effects on plants and animals, role in pollution of the environment; use of waste disposal systems for pollution abatement. (3 s.h.)

862-445 Planning in a Simulated Environment _ Techniques and limitations of environmental planning are explored through readings, lectures, discussion, and the use of an adaptation of the River Basin Model which simulates the lower Fox Valley including the city of Green Bay. Students assume various decision-makers' roles--such as government official, school director, industrialist, planner, etc.--and, in the light of many social, economic, and environmental indicators, plan for and observe the changes in the simulated region. (3 s.h.)

Graduate:

005-534 Science, Structure, Money, and Environmental Decision-Making - The relationship of the natural and social sciences to significant changes in the environment through institutions which affect the expenditure of funds is explored. Special attention is paid to corporations, universities, and government bureaus. (3 s.h.)

The introductory section explores the theory of relationships and costs. The intermediate section emphasizes case studies and depends in part on individual and/or group research projects. Neither geographical nor chronological considerations will impose limits on the selection of topics. Problem areas which may be considered include: energy, water, landscape and recreation, air, transportation; urban development, economic growth, and others. (3 s.h.)

005-534 (Cont'd)
The third section of the course attempts to synthesize the factors and values derived from the case studies toward the end of developing a pluralistic methodology for ethical environmental decision-making. (3 s.h.)

005-550 Environmental Administration - Introduction to modern techniques and concepts needed for decision-making in large-scale corporate and institutional organizations. Included within the context of systems analysis is a description of appropriate mathematical, economical, and financial ideas necessary for wise decision-making. Applications to a wide range of environmental and business oriented problems in both the private and public sectors are presented. A selected case study is analyzed to demonstrate ongoing practices in decision-making. (3 s.h.)

005-561 Global Environmental Monitoring - The gross aspects of human food supply, certain diseases, natural disaster, and environmental quality are best observed on a global basis. The course seeks to provide knowledge of scientific monitoring systems, national and international institutions including both governmental and those from the private sector, analytical techniques of evaluation and potential use of global monitoring data in providing advanced warning of issues and problems that require resolution of problems affecting people. (2 s.h.)

005-571 Physiological and Psychological Effects of Environmental Stresses - The effects of physical and psychological stresses on humans are studied. Topics include the effects of ingested substances such as lead, mercury, nitrates and the effects of noise, vibration, temperature, crowding. (3 s.h.)

005-581 Environmental Education Processes and Materials - Students are involved in experiences designed to more adequately prepare them to: (1) communicate environmental concepts; (2) develop an increased awareness of their local environment; and (3) initiate positive environmental action programs. Environmental education processes and materials that are appropriate at different age levels and relate to different areas of interest are examined. Class activities include an examination of several philosophical approaches to environmental education, utilizing local environmental resources in implementing environmental education on a day-to-day basis, and evaluating different kinds of environmental education materials. Students participate in value clarification exercises and acclimatization activities. Field trips are taken to local natural areas and to areas where people are having a particularly important impact on the environment. Resource people who are involved in significant environmental education efforts are utilized. Activities and evaluation criteria will be adapted to the needs of students with varied backgrounds, experiences, and professional interests in environmental education. (3 s.h.)

INSTITUTION: UNIVERSITY OF WISCONSIN-MADISON

PROGRAM: Environmental Communications

DEPARTMENT: Institute for Environmental Studies

DEGREE: Master of Arts in Agricultural Journalism (M.A.)
Master of Science in Journalism and Mass Communication (M.S.)

CONTACT: Dr. John Ross
Professor of Agricultural Journalism
Center for Environmental Communications and
Education Studies
University of Wisconsin-Madison
Madison, Wisconsin 53706
(608) 262-1776

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

Environmental communications is the process of planning, producing, or conducting research related to written, spoken, and/or pictorial messages about the environment. Environmental communicators seek to encourage public awareness of environmental problems; public understanding of underlying principles, issues, and options; and a public commitment to individual and collective action.

Three different Master's degree emphases in Environmental Communications are available: 1) a major in the Department of Agricultural Journalism in the College of Agricultural and Life Sciences, with a minor in environmental subjects; 2) a major in the School of Journalism and Mass Communication in the College of Letters and Science, with a minor in environmental subjects; 3) a major in a technical or scientific field, such as Land Resources, Recreation Resources Management, or Water Resources Management, with a minor in environmental communications.

This program began in March, 1966 through the Office of Conservation Education. To date there have been 64 graduates. The Center for Environmental Communications and Education Studies serves as facilitator for the program. The Center is an informal consortium of faculty and students from a number of University of Wisconsin-Madison departments, devoted to appropriate cooperative teaching, research, and extension programs. The Center aids the professional training of specialists in environmental communications, sponsors studies of environmental communications media and methods, and provides various educational symposia and services.

PROGRAM REQUIREMENTS

Admission to Environmental Communications graduate work at University of Wisconsin-Madison is based on undergraduate GPA, GRE scores, a statement of purpose, field experience, and letters of reference. Requirements vary among the participating schools, departments, and programs. There is no one curriculum in Environmental Communications at the college. Degree requirements for the various departments are:

1) Department of Agricultural Journalism -

   24 credits including a research paper or thesis on some aspect of environmental communications.

2) School of Journalism and Mass Communication -

   a) track with an emphasis on public relations (24 credits and thesis);

   b) track in specialized reporting (30 credits and a major publishable work)

3) A minor in environmental communications, while taking the degree in such fields as ecology, soils, forestry, landscape architecture, agricultural economics, or urban and regional planning.

CURRENT FACULTY, STUDENTS, GRADUATES

The faculty are in regular academic departments with part-time responsibilities in the department. Thus, it is not possible to determine how many faculty are involved with the program.

There are far more applicants than space in the program so no formal recruitment is necessary. Admissions are limited to ten students a year. In 1976-77 there were six males and four females. The program does attract "career change" students. Some students (and many applicants) have neither communications nor environmental undergraduate training.

Students are supported through national scholarships, university fellowships, department research or project assistantships, teaching assistantships, affiliated internships and special awards. Assistantships are worth $436 per month in 1977-78.

Research funding is available from the Institute for Environmental Studies, Department of Agricultural Journalism, School of Journalism and Mass Communication, and other university research facilities open to all departments.

PROGRAM PROJECTIONS

No changes in the long-range goals and objectives of the program are currently planned. The degree demand is steady and staffing is static.

ADDITIONAL INFORMATION

The Institute for Environmental Studies Executive Committee has nine members - three ex-officio and six representing agricultural and extension education, chairman of agricultural journalism, curriculum and instruction, assistant director for Institute for Environmental Studies, chairman of Center for Environmental Communications and Education Studies. The National Association for Education in Journalism had seminars on aspects of environmental communications teaching and research.

COURSE DESCRIPTION

320 Advanced General Bacteriology - Structure-function, nutritional and metabolic properties of important groups of microorganisms; a comparative study of the ecology, selective isolation and characterization of bacteria. (4 s.h.)

460 General Ecology - Relations of plants and animals to their environment, including population dynamics and community organization; lecture and lab. (4 s.h.)

567 Solar Energy Technology - Radiant energy transfer and its application to solar exchanges; energy balances for solar exchanges; review of theory, economics, and practice of solar energy applications. (2 s.h.)

423 Air Pollution - Effects, Measurement, and Control - The influence of man-caused pollution on the atmosphere, globally and locally. Evaluation of human health, economic, and aesthetic effects of air pollution. Techniques for measurement of atmosphere pollutant concentrations and determination of local and regional air quality. Detailed presentation of air pollution sources and methods for their control. The role of local, state and federal government in air pollution control. (3 s.h.)

516 Ocean Environment - Comprehensive survey of the various fields of oceanography. Four equal parts: Biological, chemical, geological and physical oceanography. Students may thus take from one to four credits. (1-4 s.h.)

550 Computers and Society - What computers are and what they do. The effect of scientific and technological development on social and economic organization. Historical examples. Possible uses of computers and computer systems, social changes which they would influence, and the choices they present. The presentation

550 (Cont'd.) - is highly interactive, using readings, guest-lectures, class discussions, creative papers, and projects. (3 s.h.)

500 Insects and Diseases in Forest Resource Management - Nature and significance of representative insects and diseases of natural and planted forests with emphasis on their control through manipulation of basic ecological and biological factors. (4 s.h.)

330 Resource-Oriented Recreation Management - Description and evaluation of characteristics and trends in outdoor recreation; causes of changes in outdoor recreation use; how use interrelates with both the environmental social systems; analysis of administrative and management processes used to solve problems arising from the recreational use of wildlands. (3 s.h.)

305 Introduction to the City - Analysis of the distributions of cities, their functions, character and relationships with their surrounding regions, and the areal patterns within cities; the spatial variation of population, economic activity, and land uses. (4 s.h.)

337 Culture and Environment - Geographic approaches to culture-nature relationships, including man's attitudes toward the environment; selected topics from contemporary and historical sources. (4 s.h.)

504 Science and Government - The effect of science and technology in demands for decisions of public policy related to theory of the role of government. (4 s.h.)

327 Science, Technology and Society - The effect of application of scientific knowledge on technology, medicine, and agriculture with attention to resultant problems raised for government and society. (3-4 s.h.)

470 The Automobile and Society - Seminar on automotive and related technologies and their interrelations with society. (3 s.h.)

602 Topics in Environmental Aspects of Mechanical Engineering - Such as cryogenic recycling, energy utilization, aquatic harvesting, underwater exploration, thermal pollution, etc. (1-3 s.h.)

528 Past Climates and Climatic Change - Climatic change throughout geologic time, especially in the last 10 millennia; mechanics of change, evidence, and criteria, paleogeography and paleoclimatology. (2 s.h.)

324 Soils and Environmental Pollution - Interaction of soils with environmental contaminants and the role of soils in pollution control. (3 s.h.)

550 Ecologic Dimensions of Environmental Impact Assessment - Philosophy amd methods of assessing the environmental impact of land-use changes and structural developments in private and public-works projects. Ecologic, economic, esthetic, and sociologic considerations in the making and implementation of environmental policy. Methods and guidelines for the preparation and use of environmental impact statements. (3 s.h.)

Other areas that courses are available from include agricultural journalism, business, communication arts, education, journalism and mass communications, law, psychology, urban and regional planning.

INSTITUTION: UTAH STATE UNIVERSITY

PROGRAM: Environmental Studies

DEPARTMENT: Natural Resources (College)

DEGREE: Bachelor of Science (B.S.) in Environmental Studies

CONTACT: Dr. Thadis W. Box
Dean, College of Natural Resources
Utah State University
Logan, Utah 84322
(801) 752-4100 x 7677

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

This interdisciplinary Bachelor Science program in environmental studies was instituted in 1973. The program was designed to offer the student more flexibility than the traditional natural resource management curriculum. The program does not usually lead to certification by professional societies, but students are able to design a program which upon graduation will qualify them for some professional positions, usually related to the natural resources occupations. Students are encouraged to assist in the design of individualized academic programs which include the investigation of current environmental issues.

The majority of students elect employment upon completion of the baccalaureate work. These students acquire occupations usually in the public sector, but approximately 29% find employment in educational institutions or with consulting firms.

PROGRAM REQUIREMENTS

The major prerequisite for admission to the College of Natural Resources is acceptance by the university. A strong science and math secondary background is preferred, however.

The general curriculum for the B.S. degree in environmental studies is made up of the following: a major area of 60 quarter hour credits of required courses; and, a minor of at least 18 self-designed quarter hour credits. In addition, 46 quarter hour credits of general education must be completed. In total, 186 quarter hour credits are required for completion of the baccalaureate work.

The required major area of course work is as follows:

A. lower division	credit	
Natural Resources 101	3	
Biology 120	5	
Soils 200	3	
Bioclimatology 325	3	
Economics 201	5	
Mechan. Engineering 216	3	
Bio. 121 or Bot. 110 or Zoo. 160	5	
Gen. Ecol./Biol. 384	5	
3 Nat. Res. principle courses	9	(41)

B. upper division	credit	
App. Statistics 321	3	
English 541	3	
Forestry 546	3	
Forestry 420 or Nat. Res. 565 or Econ. 501 or Econ. 555	3-4	
Env. law-Pol. Sci. 575	3	
Pol. Sci. 561 or 566	3-4	(18-20)

The self-designed minor of at least 18 quarter hour credits is chosen from one or several disciplines which are related to environmental studies. These courses may be selected from areas such as: biology; bacteriology; entomology; soils; biometeorology; geology; forestry; natural resources; economics; and, agricultural and irrigation engineering.

The College of Natural Resources houses the Ecology Center which is an independent research group which support fellowships in all departments. Other facilities available to the College include: the Watershed Science Unit; the Institute for Land Rehabilitation; the Agricultural Experiment Station; and other laboratories and research center located on and off the USU campus.

CURRENT FACULTY, STUDENTS, GRADUATES

The current faculty of the College of Natural Resources totals 50. It is not possible to separate those faculty who are specific to the environmental studies program. Generally, all faculty members interact with the environmental studies program.

The present enrollment includes 70 students, who are registered for the environmental studies program. Although admission requirements were specified by the College, in an effort to stabilize enrollment, there are 1,080 students enrolled in the College and 200 students registered in general studies who are adhering to the College curricula.

During the past three years, an average of 18 to 20 students annually have received the Bachelor of Science degree in environmental studies. Approximately 25% of the graduates continue their education in pursuit of advanced degrees. The fields which attract these graduates for further study include law, engineering and environmental studies.

PROGRAM PROJECTIONS

Students appear to be attracted to this program in increasing numbers. As stated previously, efforts to stabilize student enrollment were circumvented by those desirous of obtaining training in the College.

Although the number of students appears to increase annually, the faculty is not anticipated to experience significant decreases or increases.

The program itself, due to its interdisciplinary components and the high degree of student-designed curricula sequences, is not expected to change during the next few years. The faculty will continue to encourage the program's flexible nature.

COURSE DESCRIPTION

NR 101 Natural Resources and Man's Future - Relationship of resource availability, population levels, policy decision, and life styles to carrying capacity, Manipulation of natural resources to reach given objectives. (3 q.h.)

NR 360 Quantitative Analysis for Natural Resource Management - Quantitative techniques of decision making, information storage and retrieval, and simulation applied to natural resource management. (5 q.h.)

NR 380 Principles of Natural Resource Management - Problem solving, planning, and decision making presented in the context of the land manager. Extensive use of linear programming, capital budgeting, and other techniques. (5 q.h.)

NR 390 Principles of Natural Resource Policy - The political, social, and legal context of resource policy formulation. Policy viewed from historical and process perspectives. (4 q.h.)

NR 491 Directed Study - (1-5 q.h.)

NR 595 Systems Analysis in Ecology I - Philosophy, approach, and basic tools of systems ecology. Prerequisites: Differential and integral calculus, two quarters of statistics, computer programming, introductory ecology, consent of instructor for 5 credits. (1-5 q.h.)

NR 596 Systems Analysis in Ecology II - Further development and application of tools of systems ecology. (1-5 q.h.)

NR 597 Systems Analysis in Ecology III - Current state of ecosystem simulation. (1-5 q.h.)

NR 601 Directed Teaching in Natural Resources - (1-5 q.h.)

NR 691 Directed Study - 1-5 q.h.)

INSTITUTION: WASHINGTON STATE UNIVERSITY

PROGRAM: Environmental Science

DEPARTMENT: Environmental Science

DEGREE: Bachelor of Science (B.S.), Master of Science (M.S.) in Environmental Science

CONTACT: Dr. H.H.Cheng
Chairman, Environmental Sciences
Washington State University
Pullman, Washington 99164
(509) 335-3564

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The Washington State University programs of environmental science are interdisciplinary in structure. The programs draw upon the expertise and resources of several departments, including agriculture, engineering, and science and arts. This approach prepares students with broad, science-based backgrounds to meet the complex problems currently challenging man and his relationship with the natural environment. The programs lead to the Bachelor of Science and the Master of Science degrees in environmental science. These programs have been an integral part of the Washington State University offerings since 1968.

The undergraduate program is a broad-based curriculum with an area of specialization. These areas are developed cooperatively between the student and the faculty. Representative of these specializations are natural resources, environmental quality control, cultural ecology and regional land-use planning.

The Master's level program builds upon the student's undergraduate studies and also includes an area of specialization.

Facilities from across all disciplines are available to faculty and students for research and instruction. Air, water and land research projects are conducted within the Environmental and Sanitary Engineering Laboratories, the Water Research Center and the Air Pollution Research Laboratory.

Limited financial support is available to qualified graduate students in the form of fellowships and assistantships.

PROGRAM REQUIREMENTS

Admission to the environmental science programs is predicated upon acceptance by Washington State University. Normally, university and departmental requirements are completed within four years at the baccalaureate level, and two years at the master's level.

The undergraduate program course of study is individually designed by each student in conjunction with his advisor. There are six areas of specialization from which a student may select his in-depth training. These areas include agricultural ecology, biological science, cultural ecology, environmental health, natural resources, and physical science. The student must complete the general educational requirements of the university and successfully fulfill the 18 semester hours of upper division course work from his area of specialization. In addition, there is a foreign language requirement.

The Master of Science degree student in environmental sicence also is responsible for the design of a program of study. This is carried out cooperatively with a faculty advisor and a Committee from the Graduate School. The student may elect a thesis or a non-thesis option. The thesis option includes a minimum of 30 semester hours, at least 21 of which are in approved course work. The non-thesis program requires a minimum of 30 semester hours of credit including at least two, but not more than four semester hours of special problems. All course work must be at the 400 and 500 level, with the exception of six semester hours which is allowed at the 300 level.

The program at the master's level basically is outlined as follows:

Area	Minimum Semester Hours
Optional Area of Specialization	10
Physical or Applied Sciences	3
Mathematics, Statistics, or Computer Science	3
Ecology	3
Seminar, Environmental Science	1
Special Topics, Environmental Science	2
Thesis or Non-thesis Problems	variable

CURRENT FACULTY, STUDENTS, GRADUATES

The current faculty includes four full-time teaching and research personnel. In support of the full-time faculty, there are three part-time personnel. Overall, there are 75 contributing faculty members from 45 disciplines that assist in the education of the environmental science students.

At the present time, there are 35 undergraduate students of which 23 are male and 12 are female. In the graduate program, there are 52 students enrolled in the program. Graduate students include 37 male and 15 female.

Graduates of the baccalaureate and of the master's programs total 40 annually. There are approximately 20 students who are recipients of

Bachelor of Science degrees and 20 students who are awarded the Master of Science degree. Approximately 10% to 20% of the graduates, at both levels, continue their educational endeavors.

PROGRAM PROJECTIONS

Limited expansion of these programs is anticipated by the faculty and administration. Substantial changes in faculty and students is not planned for the near future. Within the next three years, however, two faculty members will be added to the current complement in order to alleviate personnel teaching responsibilities for the regional planning areas of emphasis.

COURSE DESCRIPTION

Undergraduate courses:

EnSc 101 Environment and Human Life - Interactions between humans and their environment; multidisciplinary introduction to environmental concepts and concerns. (3 s.h.)

EnSc 102 Environment and Human Life - Environmental problems; possibilities for solutions; environmental management. (1 s.h.)

EnSc 103 Environmental Field Trip - One-week field trip during spring vacation to study environmental problems and management practices from perspective of government and industry. (1 s.h.)

EnSc 199 Role of Agriculture in a Quality Environment - (1 s.h.)

EnSc 201 Assessment Methodologies in Environmental Science - Environmental assessment methodologies and integrative processes: holistic concepts, systems modeling, matrix analysis and overlay techniques. (3 s.h.)

EnSc 301 Forest and Range Environments - (3 s.h.)

EnSc 303 Conservation of Renewable Resources - (3 s.h.)

EnSc 321 Plant Diseases, Environment, and Human Welfare - (2 s.h.)

EnSc 334 Environmental Impact of Materials Processing - (3 s.h.)

Graduate courses:

EnSc 402 Earth's Resources - (3 s.h.)

EnSc 403 Environmental Geology - (3 s.h.)

EnSc 405 Noise and Man - (3 s.h.)

EnSc 444 Environmental Impact Statement Assessment - Analysis of environmental impact statements and their legal framework. (3 s.h.)

EnSc 470 Fundamentals of Air Pollution - (3 s.h.)

EnSc 480 Environmental Chemistry - (2 s.h.)

EnSc 493 Seminar - (6 s.h.)

EnSc 499 Special Problems - May be repeated for credit. (1-4 s.h.)

EnSc 510 Modeling and Simulation of Ecological Systems - (3 s.h.)

EnSc 520 Special Topics - May be repeated for credit; cummulative maximum 6 hours. (2 s.h.)

EnSc 571 Air Pollution Meteorology - (3 s.h.)

EnSc 572 Air Pollution Measurement Techniques - (2 s.h.)

EnSc 573 Air Pollution Abatement and Administration - (3 s.h.)

EnSc 574 Air Pollution Seminar - (1 s.h.)

EnSc 581 Chemistry of Natural Waters - (3 s.h.)

EnSc 582 Groundwater Chemistry - (3 s.h.)

EnSc 585 Chemistry Applied to Treatment Systems - The theory of the chemistry involved in wastewater treatment, water supply treatment, and desalination systems. (3 s.h.)

EnSc 586 Applied Stream Sanitation - Assimilating capability and complex self purification capacity of a natural water system. (3 s.h.)

EnSc 600 Special Projects or Independent Study - Variable credit.

EnSc 700 Master's Research, Thesis, and/or Examination - Variable credit

EnSc 702 Master's Special Problems, Directed Study, and/or Examination - Variable credit.

INSTITUTION: WESTERN WASHINGTON UNIVERSITY

PROGRAM: Environmental Studies

DEPARTMENT: Huxley College

DEGREE: Bachelor of Science (B.S.) in Environmental Studies

CONTACT: Dr. Ruth F. Weiner
Dean, Huxley College
Western Washington State College
Bellingham, Washington 98225
(206) 676-3000

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

Huxley College is one of several semi-autonomous colleges and schools which comprise Western Washington University. The college offers an upper division, interdisciplinary program in environmental studies. The major emphasis of the program is on the biological, physical, social and humanistic aspects of environmental problems.

The Huxley College program of environmental studies was instituted in 1970, and the first graduates were awarded the baccalaureate degree in the Spring of 1972.

PROGRAM REQUIREMENTS

Admission to Huxley College normally occurs at the junior year. A student, upon completion of the lower division course work at Western Washington University, must submit an application for admission to Huxley College.

The Huxley program of environmental studies is composed of three elements: general education (usually completed prior to admission); core requirements; and a concentration. Core requirements consist of 28 quarter hours of: Hux 304 and 305 (10 credits); Hux 398 and 498 (12 credits); and, Hux 499 (6 credits).

Students may select from the following concentrations:

I Applied Ecology and Environmental Science (scientific and technological emphasis)

1. Ecosystems
2. Environmental Health
3. Systems and Simulations
4. Marine Resources.

II Education and Human Ecology (social and humanistic emphasis)

1. Environmental Education
2. Environmental Journalism
3. Human Ecology.

III Planning and Administration (administrative emphasis)

1. Environmental Planning
2. Environmental Policy Administration.

In total, therefore, the Bachelor of Science in environmental studies requires: a minimum of 180 quarter hours; the general education program; the Huxley core; and a concentration. Ordinarily, this program requires two years of course work above the general education.

CURRENT FACULTY, STUDENTS, GRADUATES

The current full-time faculty for the environmental studies program totals 15. These personnel maintain teaching and research responsibilities. Enrollment at present is approximately 250 full-time students. Students are drawn to the Huxley program from other majors within Western Washington University. Usually, however, the program does not attract adult career-change students.

Graduates average between 60 and 70 annually. The number of students awarded the baccalaureate from Huxley has increased since the first graduating class in 1972.

PROGRAM PROJECTIONS

Program personnel would like to see the Huxley College environmental studies program expand to approximately 300 students. In response to the increase in student population, an estimated four Ph.D. personnel will be added to the faculty, within the next three to five years.

Basic program components are not anticipated to undergo substantial changes. New course offerings and revision of sequences is a possibility for the future.

COURSE DESCRIPTION (Selected)

Hux 301 Challenge of Survival - An overview of the environmental macroproblem. (4 q.h.)

Hux 304 Man, Society and Environment - Designed to give all students a common background in environmental studies. (5 q.h.)

Hux 305 Man, Society and Environment - Continuation of Hux 304. (5 q.h.)

Hux 311 Introduction to Environmental Planning - An overview of the nature of the natural and man-made environments. (4 q.h.)

Hux 312 The Planning Process - Survey of the four basic steps of the planning process, with emphasis on enabling requirements and implementation. (4 q.h.)

Hux 321a Oceanography and Marine Resources - Principles of oceanography. (3 q.h.)

Hux 321b Marine Resources Laboratory - Major marine resource environments and industries in Whatcom County. (2 q.h.)

Hux 322 Marine Bioresources - Analysis of the potential for harvest and culture of biotic resources in the oceans. (4 q.h.)

Hux 330a, 330b Applied Ecology: Applied Ecology Laboratory - Application of concepts and methods of ecological theory. (3,2 q.h.)

Hux 350a, 350b Introduction to Environmental Pollution: Environmental Pollution Laboratory - Introduction to the problems of major types of environmental pollution. (4,1 q.h.)

Hux 361 Water Pollution - Wastewater characteristics are identified. (4 q.h.)

Hux 362 Air Pollution - Types of air pollutants, their measurement and effects. (4 q.h.)

Hux 363 Quantitative Methods for Environmental Problems - A review of basic mathematics. (4 q.h.)

Hux 365 Energy and Energy Resources - The study of the energy concept as it applies to the environment. (4 q.h.)

Hux 411 Regional Environmental Planning - Functional processes of the natural systems in large-scale areas, particularly regional river basins. (4 q.h.)

Hux 412 Urban Environmental Planning - Functional relationship of major components of the urban environment. (4 q.h.)

Hux 414 Open Space Planning - Examination of open space as a basic framework for community and regional development. (4 q.h.)

Hux 422 Pollution and Marine Ecology - Major pollution problems in the oceans. (5 q.h.)

Hux 423 Techniques of Marine Analysis - A field course dealing with all forms of aquatic, biological sampling and harvesting. (4 q.h.)

Hux 436 Environmental Impact Statements - A survey of the environmental impact statement process, including requirements of state and federal environmental policy acts. (6 q.h.)

Hux 450 Environmental Biochemistry - Transformation of carbon, nitrogen, phosphorus, sulfur, and certain trace elements in soil, water, atmosphere and biological systems. (5 q.h.)

Hux 497 Coastal Environmental Assessment - To intorduce biological and physical factors necessary for environmental impact evaluation. (12 q.h.)

OTHER PROGRAMS

The four training summaries that follow describe environmental educational efforts that do not fit neatly into any category (i.e., air, wastewater, composite, etc,) as defined and utilized for the purposes of this study. While they have been considered the most relevant to the Composite - Education/Ecology Volume, their enrollment, faculty and other statistics have not been included in the tables presented, as figures are incompatible for comparison with the remainder of the Education/Ecology programs.

The four "Other Programs" reviewed for Phase II of the National Environmental/Energy Workforce Assessment are conducted by the following institutions:

Kansas State University
Miami-Dade Community College
University of Florida
University of Miami

INSTITUTION: KANSAS STATE UNIVERSITY

PROGRAM: Institute for Environmental Research

DEPARTMENT:

DEGREE: None awarded

CONTACT: Dr. Frederick H. Rohles, Director
Institute for Environmental Research
Kansas State University
Manhattan, Kansas 66506

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

With the donation of an Environmental Chamber from the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) and the completion of facilities to house this valuable equipment, the Institute for Environmental Research was dedicated in 1963. Initially, the major research thrust at the Institute was in the area of thermal comfort. Since then, however, the purposed have expanded and can be summarized as follows: 1) to study the effects of altered environments on physiology, health, comfort, learned and innate behavior, and affectivity and comfort; 2) to conduct air pollution and fine particle research relative to health and comfort; 3) to conduct research in bio-medical engineering; and 4) to provide the staff and facilities for graduate training in bio-environmental engineering.

Institute facilities and staff are used for university-wide research programs, graduate student thesis research, and private and governmental programs sponsored by agencies. Areas of research expertise include all aspects related to the interaction of man and his thermal environment (thermal comfort, humidification, air movement, clothing, physical activity, heat stress, and personal protection; fine particle technology, particularly that related to air contamination and air pollution control; modeling; foods and nutrition; comfort in the elderly; health in school children; energy conservation; and environmental requirements for laboratory animals.

Institute personnel maintain that research must be application of science and concentrated on human factors. Centered around the concerns regarding our energy use and conservation practices, the Institute cooperates with manufacturers of outdoor and wilderness materials to evaluate the durability and utility of their products under stressful conditions. Major research funding has also come from Ford Motor Company, ASHRAE, National Institute of Health (National Institute of Occupational Safety and Health), 3M Center, U.S. Air Force, and the university's Engineering Experiment Station.

The Environmental Chamber--one of the three in the world--measures 12' x 24' with an adjustable ceiling of eight to eleven feet. Studies of air temperature and mean radiant temperature can be investigated independently, and complete instrumentation measures surface and air temperatures and automatically controls all room variables. In addition to the chamber, KSU has four walk-in climatic control rooms and an isolation facility profiding temperature, humidity, sound, and light control capabilities; several Digitec Automatic Data Acquisition Systems, a Brookline Metabolic Scale, Collin Treadmill, Physiologic Monitoring equipment, an electrically heated copper manikin (only non-government one owned), and a guarded hot-cold plate built by KSU as specified by the American Society of Testing Laboratories to assess heat transfers of materials (insulation, carpets). In the Fine Particle-Air Pollution Laboratory, equipment includes a 40-foot wind tunnel, 10' x 12' test kitchen for range hood testing, and a vacuum cleaner test area.

PROGRAM REQUIREMENTS

(not applicable)

CURRENT FACULTY, STUDENTS, GRADUATES

Since its inception in 1963, over thirty-five faculty members from various KSU departments have utilized the Institute facilities. The director of the Institute serves as its sole full-time staff member with 70 percent of his time devoted to research and 30 percent devoted to teaching. At any one time, approximately ten students are engaged in research projects (75 percent undergraduates) independently or with faculty members; these students may receive some financial remuneration from available grant monies.

PROGRAM PROJECTIONS

Though KSU's Institute for Environmental Research provides an excellent interdisciplinary training ground for students interested in research and opportunities for sophisticated study by faculty members on man's internal environmental system, continued financial support is critical if the program is to expand. Already the decline in research activity at the Institute.

INSTITUTION: MIAMI-DADE COMMUNITY COLLEGE

PROGRAM: Marine Science Technology

DEPARTMENT: Marine Science Technology

DEGREE: Associate in Science

CONTACT: Mr. Joe Zawodny
Assistant Professor and Chairperson
Marine Science Technology Department
Miami-Dade Community College
1090 N.W. North River Drive
Miami, Florida 33136
(305) 324-4303

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The Marine Science Technology program has three subprogram areas: Marine Survey Technology, Marine Engineering Technology, and Marine Electronics Technology. Each of these subprograms has its own curriculum leading to the A.S. degree. The Marine Science Technology Department was formed in 1969.

The department trains marine technicians for the support of ocean engineers and scientists. Graduates are considered qualified to enter such fields as shipbuilding, marine fabrication, off-shore energy development, diving, electronics, oceanographic instrumentation, and marine research in laboratories and vessels. Recent career opportunities for which these graduates are qualified include mariculture, fish farming and pollution study.

A forty-six foot boat and a variety of tools and machines are owned by the department. Students and faculty have access to the marine facilities of such sources in the vicinity as the University of Miami, the National Oceanographic and Atmospheric Administration, and the National Fisheries Service Laboratory.

PROGRAM REQUIREMENTS

The nominal entrance requirement for any program in the college is to be eighteen years of age or older. If an eligible person is deficient in important skills, he/she will be referred to the college's learning laboratory for special instruction.

The subprograms require sixty-seven to sixty-nine semester credits for graduation. Fifteen to thirty-five of these credits are required to be in Marine Science Technology. Other required courses are in such areas as electronics, English, physics, mathematics, oceanography, and first aid. The chief focus of the Marine Electronics curriculum is electrical-mechanical instrumentation, while that of the Marine Survey program is data acquisition and processing. The Marine Engineering curriculum emphasizes the design, fabrication, installation and maintenance of equipment in the ocean environment.

During the spring or summer term, students receive three hours of credit for on-the-job experience. The faculty places students with private employers or research institutions based upon each person's interests. Participants must write papers regarding their on-the-job experiences. No pay is received.

Any student in the college is eligible to apply for scholarships, loans, or other part-time employment. Students in the Marine Science program from fishing families may apply for support from the Florida and National Sea Grant Programs.

CURRENT FACULTY, STUDENTS, GRADUATES

There are four full-time instructors in the Marine Science Technology program. An estimated one hundred full-time students are enrolled in the program, as well as approximately forty part-time students. The majority of these have entered college following high school graduation.

In recent years, an average of twelve to fifteen persons have graduated in Marine Science Technology annually. Many students leave the program prior to graduation because of the difficulty of the curriculum. Additionally, many students are reluctant to enter or continue with the program because of the low pay scales in available jobs. Most graduates are not willing to relocate, and the market for such graduates is becoming saturated in southern Florida.

An estimated thirty-five percent of the graduates continue their educations in ocean engineering or marine science programs. Of the remainder, approximately eighty percent are able to secure employment in the field, most in the private sector. A number of graduates in Marine Survey Technology have become employed by local pollution control agencies.

PROGRAM PROJECTIONS

Officials hope to combine the Marine Survey program with the now defunct Environmental Control Technology program of Miami-Dade Community College in order to meet employment needs in the environmental science field. Additionally, faculty are considering developing a certification program for persons already employed in the marine science field. This is considered necessary for upgrading skills, as a decreasing number of persons are willing to complete a full technical two-year curriculum.

Officials would like to increase enrollment to two hundred within several years, followed with a stabilization. With the planned modification and addition, and increased enrollment, two additional instructors and two technicians would be required. With these expansions it will become more likely that the proposed Marine Science facility will be approved for construction on Virginia Key.

COURSE DESCRIPTION

MAO 161 Applied Oceanography - Practical application of ocean technology. Corrosion, off-shore oil and mineral exploration, submersibles, marine materials and non-destructive testing procedures. (3 s.h.)

MAO 162 Seamanship - Introduction to rules and regulations governing boat safety, rules of the road, marlinspike seamanship, dead reckoning and piloting procedures. (2 s.h.)

MAO 163 Marine Electricity - Basic concepts and development of working skills in the field of electricity as related to marine operations. (3 s.h.)

MAO 164 Marine Engineering Practices I - Blueprint reading and sketching, slide rule applications, shop safety, use of hand and power tools used in marine shop engineering practices. (3 s.h.)

MAO 165 Operational Diving - Diving physics, underwater physiology, life support equipment, accident prevention and management, diver rescue, C.P.R. techniques, and dive planning. For certified divers. (2 s.h.)

MAO 170 Introduction to Oceanography Laboratory - Introduction to various areas of oceanographic technology. Field trips. (1 s.h.)

MAO 172 Seamanship Laboratory - Practical experience operating small boats. Emphasis on general maintenance and upkeep. (1 s.h.)

MAO 173 Marine Electricity Laboratory - Fundamental skills for wiring and splicing, use of volt-ohm meters, amprobes and meggers. (1 s.h.)

MAO 174 Marine Engineering Practices I - Laboratory - Use of measuring devices, metal-working techniques, wood-working techniques, fiberglassing, use of other tools. (1 s.h.)

MAO 175 Operational Diving Laboratory - Open water diving techniques, emphasizing individual and group responsibilities. Includes offshore trips to coral reefs, recompression chamber checkout. (3 s.h.)

MAO 176 Marine Engineering Practices II - Laboratory - Introduction and use of machine and wood shop tools. (1 s.h.)

MAO 180 Marine Engineering Practices II - Basic naval architecture and ship construction. Tonnage measurement, displacement, trim, stability, internal combustion engine, practical hydraulic power circuits. Includes work on actual units. (3 s.h.)

MAO 260 Underwater Operations I - Tools and techniques with emphasis on underwater photography and underwater navigation. (2 s.h.)

MAO 262 Underwater Operations II - Utilization of self-contained and surface air supply diving equipment. Emphasis on use of tools and diver communications. (2 s.h.)

MAO 263 Ocean Measurements I - Basic instrumentation techniques and their application to marine measurements. (3 s.h.)

MAO 265 Biological and Chemical Sampling Techniques - Construction, rigging, handling and repair of equipment. Preservation of biological specimens and basic statistical analysis. (2 s.h.)

MAO 270 Underwater Operations Laboratory - Field work with underwater photography. (3 s.h.)

MAO 271 Ocean Measurements II - Laboratory - Use of equipment at sea. (1 s.h.)

MAO 272 Underwater Operations II - Laboratory - Development of work techniques with surface air supplied equipment in training tank and offshore. (3 s.h.)

MAO 273 Ocean Measurements I - Laboratory - Practical lab work at sea including work with oceanographic equipment that utilizes the principles covered in the classroom. (1 s.h.)

MAO 274 Advanced Diving Laboratory - Further development as a research or commercial diver. New equipment, compressor maintenance, ice diving techniques, underwater cutting and welding. (3 s.h.)

MAO 275 Biological and Chemical Sampling Techniques Laboratory - Various projects assigned to students, completed in laboratory and on board research vessels. (1 s.h.)

MAO 280 Advanced Diving Techniques.- Further development of underwater skills in utilizing work support equipment. (2 s.h.)

MAO 281 Ocean Measurements II - A continuation of the study of instrumentation as applied to the marine environment. (3 s.h.)

INSTITUTION: UNIVERSITY OF FLORIDA

PROGRAM: Environmental Biology

DEPARTMENT: Environmental Engineering Sciences

DEGREE: Master of Engineering (M.E.)
Master of Science (M.S.)
Engineer
Doctor of Philosophy (Ph.D.)

CONTACT: Dr. E. E. Pyatt, Chairman
Department of Environmental Engineering Sciences
University of Florida
Gainesville, Florida 32611
(904) 392-0841

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

Department status was authorized in 1966 by the Board of Regents, but it may be traced back to 1941 in the Department of Civil Engineering. In an effort to not undermine the environmental endeavors of other departments in the university, its first name was the Department of Bio-environmental Engineering. In 1968 it was renamed the Department of Environmental Engineering Sciences.

Environmental engineering is an extremely broad field; as a result of this, the department has identified several areas on which the student may focus his/her program. These are: air pollution, environmental biology, environmental chemistry, environmental resources management, radiological health, solid wastes, systems ecology, water pollution control, and water supply.

Laboratories in the biological section offer complete facilities for investigation, at the graduate and research levels, of problems in environmental biology with emphasis in the field of water and wastewater treatment, estuarine ecology and eutrophication of marine and fresh-water systems. Aquatic biology has at its disposal a specially equipped aquatic biology laboratory, two research laboratories and a teaching laboratory for graduate students. Two large constant temperature rooms are available, one of which is equipped for photosynthetic work with algae. A special microscope room allows the advanced student an opportunity to learn microscopic techniques and photomicrography. There are substantial other support facilities available to the students, including a field laboratory facility for eutrophication studies.

The use of radionuclides has been a valuable tool to the biologist in understanding the growth of organisms and the cycling of elements in the environment. An ongoing research program in biology utilizes techniques of this kind to understand more fully the changes which are continually occurring in the aquatic ecosystem. For students who have an interest in radiobiology, the detecting instruments in the radiobiological laboratory are available for studies of this kind. Typical of research activities which are going on in this major are the following projects, entitled: Eutrophication Factors in North Central Florida Lakes, ATP Content of Marine Zooplankton and Estuarine Model for Impact of Man.

Graduates of the environmental biology option are uniquely qualified for positions in research; for this reason it is strongly recommended that a thesis be prepared.

PROGRAM REQUIREMENTS

Admission to the University of Florida's Graduate School requires an undergraduate degree from an accredited institution with a 3.0 average (on a 4.0 scale) during the junior and senior years, Graduate Record Examination scores, and other evidence of one's ability to do graduate level work.

Two distinct master's programs are available to graduate students in the Department of Environmental Engineering Sciences. Students who possess undergraduate degrees in engineering or basic sciences may pursue the Master of Science degree through a program in Environmental Sciences. Persons with degrees in non-technical fields may also be admitted to this program. Commonly, these people have completed at least one year of college-level course work in three of the following four areas: chemistry, biology, calculus, and physics. The program in Environmental Engineering leads to a Master of Engineering degree which is accredited by the Engineers' Council for Professional Development. Those who wish to enter this program must be graduate engineers. Other persons wishing to enter this program will be required to take sufficient articulation work as to bring their backgrounds into substantial agreement with those having undergraduate engineering training.

Any student who has plans to pursue a doctorate degree should prepare a thesis; however, others in either the M.S. or the M.E. programs have the option of doing a thesis or not doing one, in which case a technical paper must be prepared and presented at a seminar during their final quarter in residence. The minimum registration for a master's degree with a thesis is forty-five quarter credits, thirty-six of which are to be taken in course work and nine in thesis preparation. Thesis option students must take at least eighteen units of graduate level courses (numbered 600 or higher). The non-thesis option requires a minimum of fifty-four units, twenty-seven of which must be taken within the department and at least twenty-four at the 600 or above level. Students in each option must take eight credits outside of the department. These courses may constitute a designated minor or they may be spread over various disciplines.

The departmental core requires environmental biology, environmental chemistry, statistics, and computer programming of all students, but beyond this, it is the responsibility of the student and his/her supervisory committee to approve what program of courses is selected. Each student must pass a written and/or oral examination at the completion of his/her course work.

In addition to the required core courses the following courses would work well in this major: Water Quality Management, Estuarine Systems, Advanced Waste Treatment Operations, Ecosystems of Tropics, Man and His Environment, Public Health Engineering, Advanced Water Analysis, Introduction to Radiological Health, and Limnology.

An Engineer degree is available for engineers who require additional knowledge beyond the master's degree. This degree requires a minimum of forty-five units of graduate work beyond the master's degree, and it falls midway between the master's and the Ph.D. in the amount of work it requires. This degree is not widely recognized, so its pursuit is not encouraged. It is important to realize that an Engineer degree does not suffice in any way as partial fulfillment of Ph.D. requirements.

To be admitted to the Ph.D. program, one must have a master's degree. Once admitted, a three person supervisory committee is appointed to guide the student's research and program of study. A minimum of eight quarters in residence is required to complete the program. Very little course work is specified to allow the student and his/her committee a maximum of flexibility in tailoring a program to the needs of the individual. With the committee's approval, a student may choose one or more minor fields, restricted only by the fact that the minor should be unified relative to a clear objective. The Ph.D. candidate must demonstrate proficiency in a language other than his/her native tongue, or must complete a non-technical minor outside of the major field of interest, chosen by the supervisory committee. After all of the language requirement has been met, and substantially all of the course work is complete, the student must take a qualifying examination for candidacy status for the doctor's degree. The dissertation represents the culmination of the candidate's program and following its defense the Ph.D. degree is awarded.

CURRENT FACULTY, STUDENTS, GRADUATES

The seventeen person faculty usually expends half of its efforts on teaching and half on research, with the exception of three full-time instructors. Two of these seventeen faculty are chiefly involved with the environmental biology option.

Enrollment in the graduate program in Environmental Engineering Sciences peaked in 1973 with one hundred and twenty-five students. There are now one hundred and three people enrolled, fifteen of whom are doctoral students. This option used to have seven or eight EPA funded training grants, but this is no longer the case. Sixty-five research contracts supply financial assistance for graduate students in this program. The enrollment is declining because they are not able to provide financial assistance to more of the students.

During 1977 a total of thirty-two graduate degrees were conferred in this department. There were four recipients of the M.E., twenty-two of the M.S., and six of the Ph.D. The Engineer degree has not yet been awarded. It is not determined how many of these degrees are specific to the environmental biology option.

A follow-up study of graduates between 1971 and 1973 shows that of one hundred and thirty-three people who earned master's degrees, twenty-five were employed by consulting firms (most were M.E. graduates), fourteen were hired by industry, nineteen pursued additional degrees, thirteen went to work with health departments, nine accepted positions with EPA and the U.S. Public Health Service, fourteen are working with other governmental agencies, and six are teaching in colleges or universities.

PROGRAM PROJECTIONS

The future of this and similar environmental programs is keenly dependent upon the quality and quantity of assistance and support which is received. It has already experienced a slump in enrollment because of training fund cuts. It is anticipated that the demand for graduates, such as these, will be great as our environmental situation grows increasingly complex. During recent years, there have been many more positions available for environmentalists than there are properly qualified specialists to fill them.

Because of the withdrawal of federal support for graduate education, competition for financial aid will become increasingly intense. It is felt, however, that as students forget that federal training money existed in the past, the enrollment trend will stabilize.

COURSE DESCRIPTION

ENV 520 Environmental Biology - Basic cellular organizations and processes related to waste treatment. Role of environmental engineering in maintaining stability of fresh water, marine and terrestrial ecosystems. (4 q.h.)

ENV 522 Environmental Health - Effects of environmental pollution upon health. Methods of evaluation, treatment, and prevention of pollutants of health significance. (4 q.h.)

ENV 531 Water and Wastewater Analysis - Principles of analytical chemistry and their application to determination of chemical composition of natural waters. Emphasis on methods used in routine determinations of water quality and wastewater strength. (4 q.h.)

ENV 540 Survey of Radiological Health - A quantitative overview of radiation principles, sources, detection, measurement, and

ENV 540 (Cont'd) - protection. (4 q.h.)

ENV 551 Introduction to Air Pollution - Principal types, sources, dispersion, effects and physical, economic and legal aspects of control of atmospheric pollutants. (4 q.h.)

ENV 560 Ecological and General Systems - Systems ecology including examples, languages, theoretical formulations, and models for design, synthesis, and prediction of systems of man and nature. (4 q.h.)

ENV 600 Advanced Waste Treatment Operations - Biological, physical and chemical processes used in the treatment of wastewater. Development of design parameters and operating procedures based on experimentally derived data. (4 q.h.)

ENV 611 Water Quality Management - Water quality management applied to streams, lakes and tidal estuaries and embayments. Influence and effects of municipal and industrial wastes on public water supplies, shellfish, storage, recreational uses, and wildlife. (4 q.h.)

ENV 617 Estuarine Systems - Coastal systems, their components, processes, systems models, and management including tropical, arctic, and man-affected types. (4 q.h.)

ENV 626 Aquatic Microbiology - Role of microorganisms in fresh and marine waters which receive waste effluent or are used as public water supplies. Emphasis on phytoplankton. (4 q.h.)

ENV 627 Biology of Aquatic Systems - Macroscopic plant and animal forms which may serve as indicators of water quality in streams and lakes. (4 q.h.)

ENV 630 Environmental Chemistry - Water treatment, chemical composition of natural waters and other phases of environmental chemistry. Applications of physical and organic chemistry of aqueous and gaseous systems. (1-5 q.h.)

ENV 631 Advanced Water Analysis - Advanced chemical procedures used in water chemistry research. Application of instrumental methods to determination of trace inorganic and organic natural water constituents. (4 q.h.)

ENV 642 Radioactive Wastes - Source, treatment and disposal of radioactive wastes. Emphasis on prevention of contamination. (4 q.h.)

ENV 668 Health Hazards of Man's Environment - Environmental factors which adversely affect man's well being are related to epidemiology and human physiology. (4 q.h.)

BTY 604 Ecosystems of the Tropics - Natural and people dominated tropical ecosystems, their structure, function and relation to humans. (4 q.h.)

INSTITUTION: UNIVERSITY OF MIAMI

PROGRAM: Marine and Atmospheric Science

DEPARTMENT: Rosenstiel School of Marine and Atmospheric Science

DEGREE: Master of Science (M.S.)
Doctor of Philosophy (Ph.D.)

CONTACT: Dr. Warren Wisby, Associate Dean
Rosenstiel School of Marine and Atmospheric Science
University of Miami
4600 Rickenbacker Causeway
Miami, Florida 33149
(305) 350-7356

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The Rosenstiel School of Marine and Atmospheric Science provides a living laboratory for the study of the dynamics of physical and biological aspects of ocean systems on a seven-acre waterfront campus. The school was formally established as the Marine Laboratory in 1943 to meet the need for a tropical marine station readily accessible to the educational and scientific centers of the United States. It has grown and developed to its present position as one of the world's major marine educational and research establishments.

The school functions as a single department of the University of Miami, and offers curricula leading to the M.S. and the Ph.D. with the following majors: Biology and Living Resources, Marine and Atmospheric Chemistry, Marine Geology and Geophysics, Meteorology and Physical Oceanography. Ocean Engineering is a multidisciplinary program offered cooperatively with the university's School of Engineering and Environmental Design. Some of the school's courses are open to enrollment by undergraduate students.

On the school's campus are a variety of facilities for oceanographic research. Research laboratories include equipment for such processes as radiation detection; tritium measurements; mass spectrometry; x-ray diffraction; optical spectroscopy, atomic absorption; electron microscopy; and carbon-14, potassium-argon, and uranium-thorium dating. A catalogued biological research collection includes 27,000 lots and 2,500 species of fishes, and 11,500 lots and 3,700 species of marine invertebrates. One of the laboratories has circulating seawater aquaria throughout, and is used for biological research on marine animals. The school's library contains over 22,000 volumes. Also maintained by the school is a fleet of oceanographic research vessels and several small outboard motorboats for various research needs.

Several off-campus facilities are available to students and faculty, including the National Hurricane Center of the U.S. Weather Bureau and the National Hurricane and Experimental Laboratory of the U.S. Oceanic and Atmospheric Administration. The Comparative Sedimentology Laboratory, on Fisher Island, offers a continuing education program of seminars and short, intensive courses on selected topics for students, teachers, and professionals from industry. For research and training in marine ecology, the university operates a field station at Pigeon Key, one hundred miles south of Miami.

Students are provided opportunity for conducting and participating in research as employed research assistants and in the preparation of individual theses and dissertations. Basic and applied research is conducted with the support of many governmental and private organizations, including the National Science Foundation, the Office of Naval Research, the National Institutes of Health, the U.S. Department of the Interior, the National Weather Service, and the National Park Service. A wide range of interdisciplinary research programs are carried out.

PROGRAM REQUIREMENTS

For admission to the graduate degree program, (excluding Ocean Engineering), a student must have a bachelor's degree with a major in one of the biological or physical sciences. Prospective physical oceanographers and atmospheric scientists should have a strong background in mathematics and physics, and prospective chemical oceanographers should be well versed in the various fields of chemistry. Prospective marine geologists, geo-chemists, and geophysicists should acquire strong backgrounds in mathematics, physics, chemistry, and all basic geological disciplines. In the biological sciences, zoology is preferred to botany as an undergraduate major, but zoology students should include botany in their curricula. Those wishing to enter the field of marine biology with an emphasis in experimental biology should take strong undergraduate course work in chemistry, biochemistry, and mathematics. Students interested in systematics and fishery science should be well prepared in zoology, genetics and related fields. The following undergraduate courses are prerequisites for admission to the school's graduate programs, excluding Ocean Engineering: principles of chemistry (inorganic), composition, algebra, trigonometry, analytical geometry, calculus, and general physics (eight hours). Each program area stipulates its own additional entrance requirements.

Those students desiring entrance into the Ocean Engineering program should have a B.S. degree in an area of engineering. It is helpful, but not required, for a student to include courses in ocean engineering in the undergraduate curriculum.

The M.S. degree requires a minimum of twenty-four graduate course credits. In addition, students must enroll for six credit hours of thesis research. Thesis research and preparation is overseen by a thesis committee. The thesis must be successfully completed and defended before the six research credits are given. The M.S. degree program is normally completed in two years of full-time study.

Thirty-six course credits are the minimum requirement for the Ph.D. in the marine and atmospheric sciences. Not less than half of the total credits must be in courses numbered 600 or above. At least twenty-four of the required course credits must be taken in residence, and may include those course credits taken as part of the M.S. degree. In addition to the course requirements Ph.D. candidates must take as many credit hours of dissertation research (not less than twenty-four), as deemed appropriate by their supervisory committees. The supervisory committee is usually appointed when a student is formally admitted into a doctoral program. It plans the student's course of study and administers the qualifying examination. A dissertation committee is formed when a student is admitted to candidacy. This committee oversees the preparation of the dissertation, and conducts the final oral examination. The total time to complete the doctoral requirements is normally three years of full-time study beyond the M.S., or five years following the receipt of the bachelor's degree.

Many phases of Biology and Living Resources, Marine and Atmospheric Chemistry, Marine Geology and Geophysics, Meteorology and Physical Oceanography overlap, and students in these areas take courses in common. The programs in Meteorology and Physical Oceanography and Marine and Atmospheric Chemistry include the study of physical and chemical aspects of the ocean and atmosphere, including their circulation and chemical composition. The Marine Geology and Geophysics program involves studies of geology, geophysics, and geo-chemistry of the sea floor, and the study of processes affecting the geological history of the ocean basin and marginal seas. The Biology and Living Resources program is designed around a series of study-options which are: behavior, biochemistry, ecologies, fisheries, microbiology, physiology, and systematics.

The following briefly provides the course requirements for M.S. and Ph.D. candidates, in each of the program areas. These courses are described below under Course Description. In addition to the listed courses, other courses are available as electives in each program area.

Biology and Living Resources (BLR): The required courses are: MPO 501, MAC 502, BLR 503, MGG 504, BLR 601 or 602, and 611.

Marine and Atmospheric Chemistry (MAC): Courses normally required are: MAC 502, 504, 603, 610, 670, and six credits from 620, 630, or 660.

Marine Geology and Geophysics (MGG): Students must complete MGG 605, any three courses in the MGG 610 series, and two of the following: MPO 501, MAC 502, BLR 503, and MGG 504. Students are urged to take MGG 541.

Meteorology and Physical Oceanography (MPO): Normally required courses are: MPO 511, 551, 611, 631, 632, and OEN 575.

Students may pursue a major or a minor in Ocean Engineering. There are four areas of specialization in this program: Ocean Measurement Systems, Underwater Acoustics, Materials in the Sea, and Coastal Engineering. Ocean Engineering emphasizes the various aspects of problems relating to the ocean, and was created to fulfill the need for ocean engineers to help solve problems in such areas as coastal erosion, underwater corrosion, acoustics, and instrument design. Admission to this program and granting of the degree is under the auspices of the School of Engineering and Environmental Design. In addition to fulfilling the general degree requirements and having at least ten days aboard a research vessel at sea, those taking Ocean Engineering (OEN) as a major or a minor must take MPO 503, OEN 502, and EGN 689. A minimum of twelve credits in Ocean Engineering or Ocean Science is also required.

CURRENT FACULTY, STUDENTS, GRADUATES

The school currently houses seventy-five faculty members within the five divisions. The faculty is structured into two lines: research and academic. Fifty-seven of the seventy-five are teaching faculty.

In the marine and atmospheric sciences, there are currently approximately 150 students. Out of 314 applicants in 1975-1976, twenty-three were admitted. Many students receive financial assistance from fellowships, scholarships, loans, and research or teaching assistantships. The Graduate School, as well as many non-university organizations, contributes funding for student support.

During the 1975-1976 school year, twenty-two students received the M.S. degree, and twelve were awarded the Ph.D. Graduates have accepted positions in universities, government, international agencies, and to a lesser extent, in private industry; they enter a wide variety of positions specific to their specialty. Most accept positions on the eastern seaboard, although some move to Texas, the West coast, and overseas. Graduates of these programs rarely have difficulty obtaining employment in their field, particularly because this is the only program of this nature available in a tropical climate.

There are currently thirteen full-time and five part-time students registered in the Ocean Engineering program. During the 1975-1976 term, four students were awarded the M.S. degree. Like the other programs, these graduates rarely have difficulty finding employment in the field, and have entered a variety of organizations.

PROGRAM PROJECTIONS

Within three to five years the school administration may allow the graduate enrollment to increase to approximately two hundred. Along with this increase, a 15 to 20 percent increase in the faculty would likely occur. These expansions will be made possible due to the planned construction program, which will provide for an expansion of 75 percent over the present space. This would relieve present crowding, permit accommodation of additional academic and research faculty and their staffs, and would allow research activities to be expanded from the present seven million dollar level to the eleven or twelve million dollar range.

The administration and faculty have projected specific research and academic expansions that could be fulfilled with the new facilities. Among the projected research activities is the investigation of the biological conversion of solar energy to develop pollution-free methods of energy and food production. The planned academic expansions include the following: development of a summer program for the school's students and for students of other universities through cooperative agreements; development of semester and year-long graduate programs for students of other institutions; increasing and diversifying training institutes and short courses for professionals; and developing continuing education programs. A towing tank and hydraulics laboratory are also included in the construction plans.

ADDITIONAL INFORMATION

In addition to the degree programs described above, several other programs are offered in the university that relate to marine and atmospheric sciences. The School of Marine and Atmospheric Science and the College of Arts and Sciences jointly offer a B.A. in Marine Sciences, and a B.S. in Marine Science/Biology, Marine Science/Geology, Marine Science/Chemistry, and Marine Science/Physics. These degree programs were recently developed and may see some expansion with the proposed facility construction. Additionally, professional study of the law of the marine environment is offered in the School of Law in an interdisciplinary program conducted in cooperation with the Rosenstiel School; this is offered at the degree levels of the J.D. and the LL.M.

COURSE DESCRIPTION

MPO 501 Oceanography I (Physical) - The first section (atmospheric science and physical oceanography) of a four-part program designed as an integrated and multidisciplinary view of the ocean processes, covering the major disciplines of marine science and their applications to the study of the marine environment. (2 s.h.)

MPO 503 Introduction to Physical Oceanography - Introduction to properties of seawater, instruments and methods, heat budget, general ocan circulation, formation of water masses, dynamics of circulation, regional oceanography, waves, tides, sea level. Stresses the mathematical foundation of physical oceanographic principles. (4 s.h.)

MPO 511 Geophysical Fluid Dynamics I - The basic equations of state, continuity, and motion; wave motions and group velocity; theory of stratified fluids and internal waves; turbulence. (3 s.h.)

MPO 518 Remote Sensing of the Atmosphere - Methods and techniques for remote sensing of the earth's atmosphere. Absorbtion and scattering of radiation by atmospheric constituents. Molecular line and band absorbtion. Radiative transfer equation. Application to microwave radar, laser and optical radar. Ground and satellite radiometry. Scattering of acoustic waves by turbulence. Application to acoustic echo sounding methods. (3 s.h.)

MPO 531 Physical Meteorology - Distribution of aerosols and particulates; atmospheric radiation; spectroscopy; absorption and scattering of visible light; infrared and microwaves; probing of atmospheric properties with radar, laser, acoustic radar. (3 s.h.)

MPO 551 Introduction to Atmospheric Science - Thermodynamics of dry and moist processes; elementary dynamical meteorology; descriptions of weather systems and phenomena on all scales; structure and mechanics of the general circulation. (3 s.h.)

MPO 552 Synoptic Meteorological Laboratory - To provide laboratory experience for students enrolled in ATM 551. (1 s.h.)

MPO 601-610 Physical Oceanography Seminars - Varying topic each semester, e.g., oceanic processes, regional oceanography, problem solving; student presentation of critical reviews. (1 s.h. each)

MPO 611 Geophysical Fluid Dynamics II - Fluid motion in rotating systems; quasi-geostrophic scale analysis; Rossby waves, baroclinic instability; waves on an equatorial betaplane; boundary layers in rotating fluids. (3 s.h.)

MPO 612 Large Scale Ocean Circulation: Models and Observations - Theoretical models of the oceanic current systems; wind-driven and thermohaline circulation. Effects of bottom topography and lateral bounding. (3 s.h.)

MPO 621 Waves and Tides I - Tide-generating forces; tidal dynamics, models, analyses, and geography; tsunamis and storm surges, topographically-trapped and planetary waves. (3 s.h.)

MPO 631 Air-Sea Interaction - The flux of momentum, heat, moisture, and salt; waves; vertical distribution of energy sources and sinks near the interface; surface waves; mixed layers; large scale interactions. (3 s.h.)

MPO 632 Planetary Fluid Dynamics - Structure and dynamics of planetary scale phenomena in atmospheres and oceans; emphasis on physical processes underlying the mathematical models. (3 s.h.)

MPO 661 Synoptic Scale Meteorology - Structure and behavior of cyclones, anticyclones and other temperate latitude synoptic scale disturbances; objective analysis of synoptic observations; perturbation and stability analysis of large scale synoptic motions; barotropic and baroclinic waves. (4 s.h.)

MPO 662 Computer Models in Fluid Dynamics - Numerical techniques of dealing with dynamic problems in meteorology and oceanography. Dynamic prediction models. Initial data conditioning. Computational stability and error estimates. (4 s.h.)

MAC 502 Oceanography II (Chemical) - The second section (chemical oceanography) of a four-part program designed as an integrated and multidisciplinary view of ocean processes, covering the major disciplines of marine science, and their applications to the study of the marine environment. (2 s.h.)

MAC 504 Chemical Oceanography Laboratory and Instrumentation - Chemical and physical methods in chemical oceanography; analytical methods, including general and instrumental techniques. (1 s.h.)

MAC 603 Advanced Chemical Oceanography - Advanced study of oceans based upon a fundamental chemical approach, including relationships to areas of hydrodynamics, physical oceanography, meteorology, geology and biology. (3 s.h.)

MAC 610 Analytical Chemistry in Oceanography - Analytical chemistry applied to the marine environment: statistical methods, spectrometry, radio chemistry, electrochemistry, and special topics. (3 s.h.)

MAC 620 Physical Chemical Oceanography - Physical-chemical principles as applied to the marine environment, based on thermodynamics and the study of rate processes. (3 s.h.)

MAC 630 Organic Chemical Oceanography - The carbon cycle; review of organic composition of the marine environment; interactions between dissolved organics and the biosphere, the air-water and sediment-water interphases; organic "pollution." (3 s.h.)

MAC 660 Atmospheric Chemistry - Summary of types of chemical reactions; atmospheric physical chemistry (e.g., photochemistry, surface properties, isotopic fractionation, radioactive decay), analytical methods; general outline of current work with special emphasis on meso- and micro-scale meteorology; air-sea interface; studies with tracers including radioactive fallout, radiocarbon and tritium. (3 s.h.)

MAC 670 Chemical Oceanography Seminar - Oral presentation of special topics. Required each semester the student is in residence. (1 s.h.)

MGG 504 Oceanography IV - The fourth section (marine geology and geophysics) of a four-part program designed as an integrated and multidisciplinary view of ocean processes, covering the major disciplines of marine science, and their applications to the study of marine environment. (2 s.h.)

MGG 541 Ancient and Modern Sediments of the Southeastern United States - Field studies of marine sediments. One 4-5 day field trip to southern Appalachians and adjacent coastal plains; three one-day field trips to south and central Florida. (2 s.h.)

MGG 605 Seminar in Marine Geology and Geophysics - Group discussion of major problems of current interest in marine geology and geophysics. Appraisal and criticism of pertinent literature. (1 s.h.)

MGG 611 Sedimentation - Environmental, processes, and agents that form, transport, and deposit sediments, and the interpretation of the resulting rocks. (4 s.h.)

MGG 612 Principles of Micropaleontology - The major groups of microfossils, their study with light and electron optical systems, and their use in biostratigraphy and paleoecology. (4 s.h.)

MGG 613 Geochemistry - Principles of Physical Chemistry with applications to Earth Sciences. Ep-pH diagrams, acid base diagrams, and phase equilibria. Fundamental geochemical processes. (4 s.h.)

MGG 614 Geophysics - Study of the earth's oceanic and continental crust, mantle, and core using earthquake and explosion seismology, heat flow, and the magnetic and gravitational fields of the earth. (4 s.h.)

OEN 502 Introduction to Ocean Engineering - Laboratory and field trips designed to acquaint the student with aspects of ocean engineering and experimental oceanography. Laboratory, 3 hours. (1 s.h.)

OEN 531 Oceanographic Measurements - Theory of measurements, requirements and restraints, transducers, oceanographic measurements, navigation and data processing. (3 s.h.)

OEN 535 Introduction to Underwater Acoustics - Fundamentals of vibration, harmonic analysis, propagation of sound, acoustic concepts, plane and spherical waves, refraction, reflection, and boundary conditions, introduction to ray tracing, introduction to normal mode theory, ambient noise, transducers, and hydrophone characteristics. (3 s.h.)

OEN 551 Special Problems - Individual study and investigation of special projects and introduction into methods of research. (1-3 s.h.)

BLR 503 Oceanography III - The third section (biological oceanography) of a four-part program designed as an integrated and multidisciplinary view of ocean processes, covering the major disciplines of marine science and their application to the study of the marine environment. (2 s.h.)

BLR 601 Fishery Seminar - Discussion of topics in fishery science and resource management. Participants include students, faculty, staff, and invited lecturers. Students are required to present a seminar. (1 s.h.)

BLR 602 Biological Oceanography Seminar - Participants include students, faculty and invited lecturers. Students receiving credit are required to present a seminar. (1 s.h.)

BLR 611 Ecology of Marine Organisms - Types of environment in the ocean, with special references to shallow tropical seas; the relation of distributions to the physical and chemical environment; effects of environmental changes; breeding cycles; plankton and food chains, causes of population fluctuations. Application of ecological techniques to local problems. Lectures, conferences, and field trips. (4 s.h.)

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APPENDICES

Photo reprinted from the University of Illinois Institute of Technology Booklet

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APPENDIX I

DEGREE ABBREVIATIONS

APPENDIX I

Degree Abbreviations

A.A.	Associate of Arts
A.A.Ag.	Associate of (in) Applied Agriculture
A.Ag.	Associate of (in) Agriculture
A.A.P.C.T.	Associate Degree in Air Pollution Control Technology
A.A.S.	Associate of Applied Science
A.B.	Bachelor of Arts
A.D.	Associate Degree
A.E.T.	Associate in Engineering Technology
A.M.T.	Associate of Mining Technology
A.N.E.T.	Associate of Nuclear Engineering Technology
A.S.	Associate in Science
A.S.E.M.T.	Associate of Science in Engineering Mining Technology
A.T.	Associate of Technology
B.A.	Bachelor of Arts
B.E.M.T.	Bachelor of Engineering in Mining Technology
B.S.	Bachelor of Science
B.S. (N.E.)	Bachelor of Science in Nuclear Engineering
B.S. (N.E.S.)	Bachelor of Science (Nuclear Engineering Sciences)
B.S. (N.R.)	Bachelor of Science in Natural Resources
B.S.A.	Bachelor of Science in Agriculture
B.S.C.E.	Bachelor of Science in Civil Engineering
B.S.Ch.E.	Bachelor of Science in Chemical Engineering
B.S.E.	Bachelor of Science in Engineering
B.S.E.H.	Bachelor of Science in Environmental Health
B.S.E. (N.E.)	Bachelor of Science (Nuclear Engineering)
B.S.E.S.	Bachelor of Science in Engineering Sciences
B.S.N.E.	Bachelor of Science in Nuclear Engineering
B.T.	Bachelor of Technology
Cert.	Certificate

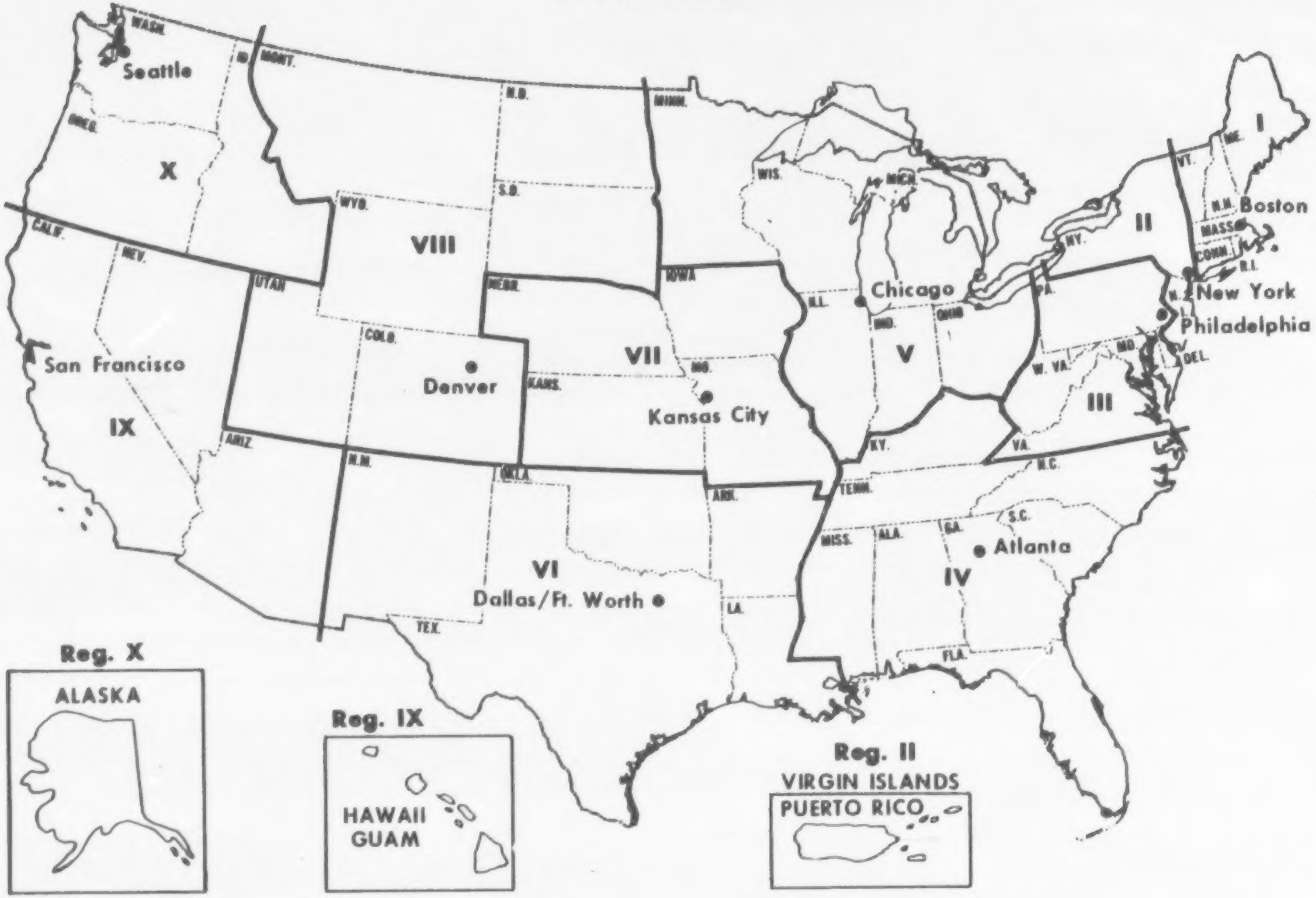
D.E.	Doctor of Engineering
D.P.H.	Doctor of Public Health
D.S.	Doctor of Science
D.S. (Hyg.)	Doctor of Science Hygiene
D.Sc.	Doctor of Science
Dr.P.H.	Doctor of Public Health
E.E.	Environmental Engineer
Eng.	Engineer
Engr.	Engineer
Engr.Sc.D.	Doctor of Engineering Science
Env.E.	Environmental Engineer
Envir.Eng.	Environmental Engineer
M.A.	Master of Arts
M.Ag.	Master of Agriculture
M.Agr.	Master of Agriculture
M.A.S.	Master of Applied Science
M.C.E.	Master of Civil Engineering
M.E.	Master of Engineering
M.E.E.E.	Master of Engineering in Environmental Engineering
M.E.A.S.	Master of Environmental Arts and Science
M.E.H.S.	Master of Environmental Health Sciences
M.E.M.	Master of Environmental Management
M.E.P.C.	Master in Environmental Pollution Control
M.Eng.	Master of Engineering
M.Engr.	Master of Engineering
M.F.	Master of Forestry
M.M.E.	Master of Mechanical Engineering
M.P.	Master of Philosophy
M.P.A.	Master of Public Affairs
M.P.H.	Master of Public Health
M.P.P.P.M.	Master of Plant Protection and Pest Management

M.P.S.	Master of Professional Studies
M.S.	Master of Science
M.S. (Hyg.)	Master of Science Hygiene
M.S.C.E.	Master of Science in Civil Engineering
M.S.Ch.E.	Master of Science in Chemical Engineering
M.S.E.	Master of Science in Engineering
M.S.E.E.	Master of Science in Environmental Engineering
M.S.En.E.	Master of Science in Environmental Engineering
M.S.Eng. S.	Master of Science in Environmental Engineering
M.S.Eng. Sci.	Master of Science in Engineering Science
M.S.E.H.	Master of Science in Environmental Health
M.S.E.M.P.	Master of Science in Energy Management and Policy
M.S.E.S.	Master of Science in Environmental Science (Studies)
M.S.P.H.	Master of Science in Public Health
M.S.(S.E.)	Master of Science in Sanitary Engineering
M.S.(S.S.)	Master of Science in Sanitary Science
N.E.	Nuclear Engineering
Nuc. Eng.	Nuclear Engineering
Ph.D.	Doctor of Philosophy
S.B.	Bachelor of Science
Sc.D.	Doctor of Science
S.M.	Master of Science

APPENDIX II

TERMINOLOGY

STANDARD REGIONAL BOUNDARIES
TEN REGIONS


WASH.
Seattle
ID.
MONT.
N.D.
MINN.
OREG.
X
WYO.
S.D.
VIII
WIS.
MICH.
ME.
I
VT.
N.H.
Boston
MASS.
CONN.
R.I.
N.Y.
II
CALIF.
NEV.
UTAH
NEBR.
IOWA
ILL.
Chicago
IND.
OHIO
PA.
N.J.
New York
Philadelphia
DEL.
MD.
W. VA.
III
VA.
San Francisco
COLO.
Denver
KANS.
VII
MO.
Kansas City
V
IX
ARIZ.
N.M.
OKLA.
KY.
TENN.
N.C.
ARK.
S.C.
MISS.
ALA.
GA.
Atlanta
VI
Dallas/Ft. Worth
IV
LA.
TEX.
FLA.
Reg. X
ALASKA
Reg. IX
HAWAII
GUAM
Reg. II
VIRGIN ISLANDS
PUERTO RICO

TERMINOLOGY

ACT (American College Testing) and SAT (Scholastic Aptitude Test) - Standardized examinations which are intended to provide applicants and institutions with a numerical statement of an individual's ability and readiness to successfully complete college/university level work.

Co-op program - A plan whereby a student receives financial assistance and academic credit under the direction of a cooperating employment site representative and a faculty advisor in exchange for an agreed upon condition of employment. Students must complete all degree requirements as per the norm.

Course - For the purpose of this study, a course is considered a unit of a program, in which a body of knowledge is presented, the satisfactory completion of which leads to the awarding of a predetermined or individually arranged number of credits.

ECPD (Engineers' Council for Professional Development) - Accrediting body for programs in engineering technology.

ERIC (Educational Resources Information Center) - A national information system designed and developed by the U.S. Office of Education, and now supported and operated by the National Institute of Education (NIE), for providing ready access to descriptions of exemplary programs, research and development efforts, and related information that can be used in developing more effective educational programs.

GRE (Graduate Record Examination) - (General Aptitude) An examination of verbal and mathematical competency and aptitude, which is designed to provide a numerical indication of an individual's ability to successfully complete advanced level work. For the purposes of the study, the GRE will not refer to the Advanced Examinations.

Internship/Applied Study Term - An arrangement which is intended to provide a simulation of work experience under the direction of academic advisors and is designed to be an integral segment of an individual's academic program. (College credit may be given.)

IRIS (Instructional Resources Information System) - A computerized information base listing materials relating to education and training in the water quality control field, which is located in the National Training and Operational Technology Center of the U.S. Environmental Protection Agency.

MEDLINE - Computerized literature search services with application to medical information.

NTIS (National Technical Information Service) - Computerized literature search services.

Program - For the purpose of this study, a plan of study, either completely prescribed, or containing options, with an identity of its own, and standard rules and procedures, the satisfaction of which may lead to a degree, certificate, or diploma.

Quarter hours - vs. - Semester hours - One semester hour is the credit equivalent to one and a half quarter hours.

Standard Federal Boundaries - Geographic division of the United States for the purposes of decentralized administration; in this report also referred to as EPA regions (see map on preceding page).

TOXLINE - Computerized literature search services with particular application to the recall of information concerning toxic substances.

WRSIC (Water Resources Scientific Information Center) - Collects, screens, organizes and disseminates reports in water resources.

APPENDIX III

SELECTED BIBLIOGRAPHY

SELECTED BIBLIOGRAPHY

Articles and Periodicals

Air Pollution Control Association. *Journal of the Air Pollution Control Association*. Vol. 27, No. 10 (October, 1977).

Carter, Jimmy. "My Views on the Environment". *EPA Journal*. (January, 1977).

Cota, Harold M. "1975 APCA Colleges and Universities Survey". *Journal of the Air Pollution Control Association*. Vol. 25, No. 3 (March, 1975).

Cota, Harold M. "Air Pollution Control Training in Colleges and Universities". *Journal of the Air Pollution Control Association*. Vol. 26, No. 10 (October, 1976).

"Engineering College Research and Graduate Study", special issue *Engineering Education*. Vol. 67, No. 6 (March, 1977)

Moeller, Dade W. "The Crisis in Air Pollution Manpower Development". *Journal of the Air Pollution Control Association*. Vol. 24, No. 9 (September, 1974).

Moore, Joseph H. and Will, Robert K. "Baccalaureate Programs in Engineering Technology". *Engineering Education* (January, 1977).

Patterson, James W. and Male, James W. "Baccalaureate Programs: *Environmental Engineering*. (January, 1978).

Shank, Bruce and Ross, Eloise. "Structural Pest Control Schools - Where are the Students?" *Pest Control* (April, 1977).

Books

American Association of Community and Junior Colleges. *1977 Community, Junior, and Technical College Directory*. Washington, D.C.: American Association of Community and Junior Colleges, 1977.

Association of Environmental Engineering Professors, American Academy for Environmental Engineering Graduate Programs. *Register of Environmental Engineering Graduate Programs*. Third Edition. July, 1974.

Barron's Educational Series, Inc. *Barron's Guide to the Two-Year Colleges, Vol. 2: Occupational Program Selection*, 1975.

Cass, James M. and Birmbaum, Max. *Comparative Guide to Two-Year Colleges and Career Programs*. New York: Harper and Row, 1976.

Chronicle Guidance Publications. *1976-1977 Guide to the Four Year College Majors*. New York: Chronicle Guidance Publications.

Colgate, Craig, Jr., ed. *National Trade and Professional Associations of the United States and Canada, and Labor Unions*. 12th Annual Edition. Washington, D.C.: Columbia Books, Inc., 1975.

The College Blue Book - 15th Edition, Degrees Offered by College and Subject. New York: McMillan Information, 1975.

Council of Graduate Schools in the United States, Graduate Record Examinations Board. *Graduate Programs and Admissions Manual 1976-1977, Volume C: Physical Sciences, Mathematics, and Engineering*.

Engineers' Council for Professional Development. *Accredited Programs Leading to Degrees in Engineering, 1976*.

Miller, G. Tyler, Jr. *Replenish the Earth - A Primer in Human Ecology*. California: Wadsworth Publishing Company, 1972.

National Association for Environmental Education. *Selected Environmental Education Programs in North American Higher Education*. Edited by Arden L. Pratt, 1974.

National Wildlife Federation. *Conservation Directory 1977*. Edited by Gloria H. Decker. Washington, D.C.: National Wildlife Federation, 1977.

Peterson's Guides, Inc. *Peterson's Guide to Graduate Study: Biological and Health Sciences*, 1976.

Peterson's Guides, Inc. *Peterson's Guide To Graduate Study: Engineering and Applied Sciences*, 1976.

Phillips, Ione. *The Added Dimension: State and Land-Grant Universities Serving State and Local Government*. Washington, D.C.: National Association of State Universities and Land-Grant Colleges.

South Carolina Department of Education. *Environmental Education, A Source Book for Educators*. Edited by Jonathon M. Wert, 1976.

The Onyx Group, Inc. *Environment, U.S.A., A Guide to Agencies, People, and Resources*. Glenn L. Paulson, adv. ed. New York: Bowker Company, 1974.

Vivian, V. Eugene. *Sourcebook for Environmental Education*. St. Louis: Mosby, 1973.

Public Documents

Council on Environmental Quality. The Sixth Annual Report of the Council on Environmental Quality. Washington, D.C.: U.S. Government Printing Office, 1975.

Council on Environmental Quality. The Seventh Annual Report of the Council on Environmental Quality. Washington, D.C.: U.S. Government Printing Office, 1976.

Council on Environmental Quality. The Eighth Annual Report of the Council on Environmental Quality. Washington, D.C.: U.S. Government Printing Office, 1977.

U.S. Department of Commerce, Bureau of the Census. Statistical Abstract, 1977.

U.S. Department of Health, Education and Welfare, Education Division, National Center for Education Statistics. Directory of Post-Secondary Schools with Occupational Programs, 1975-76.

U.S. Department of Health, Education and Welfare, Office of Education. Education Associations 1976.

U.S. Department of Health, Education and Welfare, Education Division, National Center for Education Statistics. Education Directory: Colleges and Universities 1976-77.

U.S. Department of Health, Education and Welfare, Education Division, National Center for Education Statistics. Education Directory: State Education Agency Officials 1976-77.

U.S. Department of Health, Education and Welfare. Fundamentals of Environmental Education. November, 1976.

U.S. Department of Health, Education and Welfare. Preventing Environmentally Related Diseases, 1977.

U.S. Department of Labor, Bureau of Labor Statistics. Occupational Projections and Training Data, 1976. Washington, D.C.: U.S. Government Printing Office, 1976.

U.S. Energy Research and Development Administration, Division of Labor Relations. Nuclear Engineering - Enrollments and Degrees. September, 1975.

U.S. Energy Research and Development Administration, Office of University Programs/Manpower Assessment Office. Radiation Protection Enrollment and Degrees, 1976. ERDA 77-101. August, 1977.

U.S. Environmental Protection Agency, Office of Federal Activities. *Academic Fellowships, Fiscal Years 1976-1977*. Computer printout.

U.S. Environmental Protection Agency, Office of Federal Activities. *Academic Training Grants, Fiscal Years 1975-1977*. Computer Printout.

U.S. Environmental Protection Agency, Manpower and Technical Information Branch. *Air Pollution Fellowships*. 1977.

U.S. Environmental Protection Agency. *Annotated Bibliography of Federal Government Publications on Environmental Education*.

U.S. Environmental Protection Apency. *Career Choices*. Revised January, 1977.

U.S. Environmental Protection Agency, Control Programs Development Division, Air Pollution Training Institute. *Chronological Schedule of Air Pollution Control Training Courses - October 1977 through September 1978*, 1977.

U.S. Environmental Protection Agency. *Choose A Career Which Allows A Future*, 1974.

U.S. Environmental Protection Agency, Office of Public Affairs. "Clean Water and Agriculture". January, 1977.

U.S. Environmental Protection Agency, New England Regional Office. *Environmental Training Programs in New England*. October, 1976.

U.S. Environmental Protection Agency, "EPA Noise Control Program Progress To Date". March, 1977.

U.S. Environmental Protection Agency, Office of Education and Manpower Planning. *Guidelines to Career Development for Wastewater Treatment Plant Personnel*. September, 1973.

U.S. Environmental Protection Agency. *Manpower and Training Needs for Air Pollution Control*, 1970.

U.S. Environmental Protection Agency, Office of Noise Abatement and Control. "Noise and Its Measurement". February, 1977.

U.S. Environmental Protection Agency. *Study of Manpower Needs for Implementation of the Water Pollution Control Act Amendments of 1972 - Report No. 2*. November, 1975.

U.S. Environmental Protection Agency, Office of Toxic Substances. "Toxic Substances Control Act". October, 1976.

U.S. Environmental Protection Agency, Office of Planning and Management, Office of Education and Manpower Planning. 1973-75 Training Programs. July, 1973.

U.S. Environmental Protection Agency. Working Towards a Better Environment - Some Career Choices. Revised April, 1975.

U.S. Federal Energy Administration. Careers in Energy Industries, 1975.

Reports

A Classification System for Water and Wastewater Facilities and Personnel. Association of Boards of Certification for Operating Personnel in Water and Wastewater Utilities. (April, 1976).

Daggette, John R. Energy-Related Technology Programs in Community and Junior Colleges: An Analysis of Existing and Planned Programs. Oak Ridge Associated Universities, Manpower Development Division. Washington, D.C.: U.S. Government Printing Office, 1976.

Engineers' Council for Professional Development. List of Accredited Programs Leading to Degrees in Engineering Technology, 1976.

Hammond, Paul B. and Whittenberger, James L. et. al. "Professional and Scientific Education and Personnel". Human Health and the Environment - Some Research Needs. Report of the Second Task Force for Research Planning in Environmental Health Science, U.S. Department of Health, Education and Welfare, Public Health Service, National Institutes of Health, National Institute of Environmental Health Sciences, 1976.

Hartford State Technical College. A Listing of Nuclear Chemistry, Nuclear Engineering, Nuclear Engineering Technology, Nuclear Science, Nuclear Science and Engineering, and Nuclear Science Technology Programs.

Haughey, Francis I. Radiation Science Graduates 1962-1967, Summary: Radiation Protection Enrollment and Degrees (Degrees Granted July 1965 - July 1975). Rutgers University, State University of New Jersey.

Middlebrooks, E.J. Proposed Policy on Manpower Needs for Environmental Engineering. Prepared for the Association of Environmental Engineering Professors.

Mingle, James R. Degree Output in the South, Distribution by Sex, 1974-75. Atlanta, Georgia: Southern Regional Education Board, 1977.

National Academy of Sciences. Manpower for Environmental Pollution Control. A report to the EPA from the Committee for Study of Environmental Manpower; Committee on Human Resources, National Research Council. Washington, D.C.: National Academy of Sciences, 1977.

National Association for Environmental Education. Current Issues in Environmental Education - II: Selected Papers from the Fifth Annual Conference of the National Association for Environmental Education. Edited by Robert Marlett. Columbus: The ERIC Center for Science, Mathematics and Environmental Education, 1976.

National Field Research Center, Inc. An Environmental Manpower Projection Study. 7 volumes. Prepared for the EPA and the Illinois Board of Higher Education. Iowa City, Iowa: 1975.

National Field Research Center, Inc. A National Environmental/Energy Workforce Assessment. 70 volumes. Prepared for the EPA. Iowa City, Iowa: 1977.

National Field Research Center, Inc. State of Illinois, Environmental/Energy Education in the Public Community College System. Prepared for the EPA and the Illinois Board of Higher Education. Iowa City, Iowa: 1975.

National Planning Association. The Demand for Scientific and Technical Manpower in Selected Energy-Related Industries, 1970-1985: A Methodology Applied to a Selected Scenario of Energy Output.

National Science Foundation. A Report to the President and Congress: Federal Support to Universities, Colleges, and Selected Non-Profit Institutions, Fiscal Year 1975. Surveys of Science Series, NSF 77-311, 1975.

National Science Foundation. Detailed Statistical Tables, Appendix B: A Report to the President and Congress; Federal Support to Universities, Colleges, and Selected Nonprofit Institutions, Fiscal Year 1975. Surveys of Science Resources Series, NSF 77-303.

National Science Foundation. Expenditures for Scientific Activities at Universities and Colleges, Fiscal Year 1975. Surveys of Science Resources Series, NSF 77-307.

National Science Foundation. Graduate Science Education, Student Support and Post Doctorals - Fall, 1975. Surveys of Science Series, NSF 77-313, 1975.

Oelhaf, Robert C. The Economics of Organic Farming. Ph.D. Dissertation, University of Maryland, 1976.

Robert, John B. Summary of the 3rd National Environmental Engineering Education Conference. Sponsored by the American Academy of Environmental Engineers and the Association of Environmental Engineering Professors at Drexel University, August 13, 14, and 15, 1973.

APPENDIX IV

PARTICIPATING INSTITUTIONS
BY
ENVIRONMENTAL CATEGORY

APPENDIX IV

PARTICIPATING INSTITUTIONS BY ENVIRONMENTAL CATEGORY

CATEGORY	INSTITUTION	LOCATION
AIR	Carnegie-Mellon University	Pittsburgh, PA
	Clemson University	Clemson, SC
	Drexel University	Philadelphia, PA
	George Washington University-NASA	Hampton, VA
	Harvard University School of Public Health	Boston, MA
	Hudson Valley Community College	Troy, NY
	Massachusetts Institute of Technology	Ithaca, NY
	Michigan Technological University	Houghton, MI
	Middlesex County College	Edison, NJ
	Muskingum Area Technical College	Zanesville, OH
	New Jersey Institute of Technology	Newark, NJ
	North Carolina State University	Chapel Hill, NC
	North Dakota State School of Science	Wahpeton, ND
	Northeastern University	Boston, MA
	Ohio State University	Columbus, OH
	Portland State University	Portland, OR
	Prairie State Community College	Chicago Heights, IL
	Purdue University	West Layfayette, IN
	Rensselaer Polytechnic Institute	Troy, NY
	Rutgers-The State University of New Jersey	New Brunswick, NJ
	Springfield Technical Community College	Springfield, MA
	Stevens Institute of Technology	Hoboken, NJ
	Sumter University	Sumter, SC
	Syracuse University	Syracuse, NY
	Temple University	Philadelphia, PA
	The Pennsylvania State University	University Park, PA
	University of Cincinnati	Cincinnati, OH
	University of Delaware	Newark, DE
	University of Florida	Gainesville, FL
	University of Iowa	Iowa City, IA
	University of Kentucky	Lexington, KY
	University of Maryland	College Park, MD
	University of Michigan	Ann Arbor, MI
	University of Missouri-Rolla	Rolla, MO
	University of North Carolina	Chapel Hill, NC
	University of Pittsburgh	Pittsburgh, PA
	University of Tennessee	Knoxville, TN
	University of Texas-Austin	Austin, TX
	University of Washington	Seattle, WA
	University of Wisconsin-Milwaukee	Milwaukee, WI
	Vanderbilt University	Nashville, TN
	Washington State University	Pullman, WA
	Washington University	St. Louis, MO
	West Virginia University	Morgantown, WV
	Yale University	New Haven, CT

APPENDIX IV

PARTICIPATING INSTITUTIONS BY ENVIRONMENTAL CATEGORY

CATEGORY	INSTITUTION	LOCATION
COMPOSITE:	Antioch College	Yellow Springs, OH
	Baylor University	Waco, TX
	Bemidji State University	Bemidji, MN
	California Institute of Technology	Pasadena, CA
	California Polytechnic State University	San Luis Obispo, CA
	Catholic University of America	Washington, DC
	Carnegie-Mellon University	Pittsburgh, PA
	Chattanooga State Technical Community College	Chattanooga, TN
	Clarkson College	Potsdam, NY
	Clemson University	Clemson, SC
	Cornell University	Ithaca, NY
	Delaware Technical and Community College	Newark, DE
	Delgado College	New Orleans, LA
	Drexel University	Philadelphia, PA
	Duke University	Durham, NC
	East Central Oklahoma State University	Ada, OK
	East Tennessee State University	Johnson City, TN
	Evergreen State College	Olympia, WA
	Ferris State College	Big Rapids, MI
	Florida International University	Miami, FL
	Georgia Institute of Technology	Atlanta, GA
	Heed University	Hollywood, FL
	Hocking Technical College	Nelsonville, OH
	Howard University	Washington, DC
	Hunter College	New York, NY
	Indiana University	Bloomington, IN
	Iowa State University	Ames, IA
	Johns Hopkins University	Baltimore, MD
	Kansas State University	Manhattan, KS
	Kirkwood Community College	Cedar Rapids, IA
	Lamar University	Beaumont, TX
	Macalester College	St. Paul, MN
	Massachusetts Institute of Technology	Cambridge, MA
	McNeese State University	Lake Charles, LA
	Miami University	Oxford, OH
	Michigan State University	East Lansing, MI
	Middle Tennessee State University	Murfreesboro, TN
	Morehead State University	Morehead, KY
	Muskingum Area Technical College	Zanesville, OH
	New Jersey Institute of Technology	Newark, NJ
	North Carolina State University	Raleigh, NC
	Northland College	Ashland, WI
	Ohio State University	Columbus, OH

APPENDIX IV

PARTICIPATING INSTITUTIONS BY ENVIRONMENTAL CATEGORY

CATEGORY	INSTITUTION	LOCATION
COMPOSITE: (Cont'd)	Ohio University	Athens, OH
	Oscar Rose Junior College	Midwest City, OK
	OSU Oklahoma City Technical Institute	Oklahoma City, OK
	Polytechnical Institute of New York	Brooklyn, NY
	Princeton University	Princeton, NJ
	Purdue University	West Lafayette, IN
	Raymond Walters General and Technical College (University of Cincinnati	Cincinnati, OH
	Rensselaer Polytechnical Institute	Troy, NY
	Rutgers University	New Brunswick, NJ
	Sam Houston State University	Huntsville, TX
	Sangamon State University	Springfield, IL
	Slippery Rock State College	Slippery Rock, PA
	Springfield Technical and Community College	Springfield, MA
	Stevens Institute of Technology	Hoboken, NJ
	Syracuse University	Syracuse, NY
	Temple University	Philadelphia, PA
	Texas A & M University	College Station, TX
	The Cooper Union	New York, NY
	The Pennsylvania State University	University Park, PA
	University of Alabama	University, AL
	University of Alaska	Fairbanks, AK
	University of Arkansas	Fayetteville, AR
	University of California-Santa Barbara	Santa Barbara, CA
	University of Cincinnati	Cincinnati, OH
	University of Delaware	Newark, DE
	University of Florida	Gainesville, FL
	University of Georgia	Athens, GA
	University of Kansas	Lawrence, KS
	University of Louisville	Louisville, KY
	University of Maine-Orono	Orono, Maine
	University of Michigan	Ann Arbor, MI
	University of Minnesota	Minneapolis, MN
	University of North Carolina	Chapel Hill, NC
	University of Oklahoma	Norman, OK
	University of Pittsburgh	Pittsburgh, PA
	University of Tennessee	Knoxville, TN
	University of Toledo	Toledo, OH
	University of Utah	Salt Lake City, UT
	University of Washington	Seattle, WA
	University of Wisconsin-Green Bay	Green Bay, WI
	University of Wisconsin-Madison	Madison, WI
	Utah State University	Logan, UT

APPENDIX IV

PARTICIPATING INSTITUTIONS BY ENVIRONMENTAL CATEGORY

CATEGORY	INSTITUTION	LOCATION
COMPOSITE: (Cont'd)	Vanderbilt University	Nashville, TN
	Virginia Polytechnic Institute and State University	Blacksburg, VA
	Washington State University	Pullman, WA
	Western Kentucky University	Bowling Green, KY
	Western Washington University (Huxley College of Environmental Studies)	Bellingham, WA
	West Virginia University	Morgantown, WV
	Yale University	New Haven, CT
ENERGY:	Bluefield State College	Bluefield, WV
	Brigham Young University	Provo, UT
	Carnegie-Mellon University	Pittsburgh, PA
	Columbia University	New York, NY
	Cornell University	New York, NY
	Georgia Institute of Technology	Atlanta, GA
	Hartford State Technical College	Hartford, CT
	Kansas State University	Manhattan, KS
	Lamar University	Beaumont, TX
	Massachusetts Institute of Technology	Cambridge, MA
	Morehead State University	Morehead, KY
	Muskingum Area Technical College	Zanesville, OH
	Oregon State University	Corvallis, OR
	Pikeville College	Pikeville, KY
	Polytechnic Institute of New York	Brooklyn, NY
	Princeton University	Princeton, NJ
	Purdue University	West Lafayette, IN
	Rensselaer Polytechnic Institute	Troy, NY
	Southern Technical Institute	Marietta, GA
	Texas State Technical Institute	Waco, TX
	The Pennsylvania State University	University Park, PA
	University of California-Berkeley	Berkeley, CA
	University of Florida	Gainesville, FL
	University of Kentucky	Lexington, KY
	University of New Mexico	Albuquerque, NM
	University of Pennsylvania	Philadelphia, PA
	University of Tennessee	Knoxville, TN
	West Virginia Institute of Technology	Montgomery, WV
	West Virginia University	Morgantown, WV

APPENDIX IV

PARTICIPATING INSTITUTIONS BY ENVIRONMENTAL CATEGORY

CATEGORY	INSTITUTION	LOCATION
NOISE:	George Washington University-NASA	Hampton, VA
	Georgia Institute of Technology	Altanta, GA
	Massachusetts Institute of Technology	Cambridge, MA
	Memphis State University	Memphis, TN
	North Carolina State University	Raleigh, NC
	The Pennsylvania State University	University Park, PA
	University of Cincinnati	Cincinnati, OH
	University of Pittsburgh	Pittsburgh, PA
	University of Tennessee	Knoxville, TN
	University of Tennessee Center for Health Sciences	Memphis, TN
PESTICIDES:	Abraham Baldwin Agricultural College	Tifton, GA
	Broward Community College	Ft. Lauderdale, FL
	Central Technical Community College	Hastings, NE
	Delgado Community College	New Orleans, LA
	Harvard University School of Public Health	Boston, MA
	Mississippi State University	Mississippi State, MS
	New Mexico State University	Las Cruces, NM
	North Carolina State University	Raleigh, NC
	Ohio State University	Columbus, OH
	Oregon State University	Corvallis, OR
	Rutgers State University of New Jersey	New Brunswick, NJ
	State University of New York at Farmingdale	Farmingdale, NY
	Texas A & M University	College Station, TX
	The Pennsylvania State University	University Park, PA
	University of California-Berkeley	Berkeley, CA
	University of California-Davis	Davis, CA
	University of California-Riverside	Riverside, CA
	University of Cincinnati	Cincinnati, OH
	University of Delaware	Newark, DE
	University of Georgia	Athens, GA
	University of Iowa	Iowa City, IA
	University of Maryland	College Park, MD
	University of New Hampshire	Durham, NH
	University of Pittsburgh	Pittsburgh, PA
	University of Rochester	Rochester, NY
	Utah State University	Logan, UT

APPENDIX IV

PARTICIPATING INSTITUTIONS BY ENVIRONMENTAL CATEGORY

CATEGORY	INSTITUTION	LOCATION
POTABLE WATER:	Atlanta University Center/Georgia Institute of Technology	Atlanta, GA
	Brigham Young University	Provo, UT
	California State University	Sacramento, CA
	Carnegie-Mellon University	Pittsburgh, PA
	Casper College	Casper, WY
	Central Technical Community College	Hastings, NE
	Clarkson College	Potsdam, NY
	Clemson University	Clemson, SC
	Colorado State University	Fort Collins, CO
	Community College of Denver-Red Rocks	Golden, CO
	Cornell University	Ithaca, NY
	Delgado College	New Orleans, LA
	Drexel University	Philadelphia, PA
	East Maine Vocational Technical Institute	Bangor, ME
	Hudson Valley Community College	Troy, NY
	Illinois Institute of Technology	Chicago, IL
	Iowa State University	Ames, IA
	J. Sargeant Reynolds Community College	Richmond, VA
	Kansas State University	Manhattan, KS
	Kirkwood Community College	Cedar Rapids, IA
	Linn-Benton Community College	Albany, OR
	Manhattan College	New York, NY
	Marquette University	Milwaukee, WI
	Massachusetts Institute of Technology	Cambridge, MA
	Miami-Dade Community College	Miami, FL
	Michigan Technological University	Houghton, MI
	Middlesex Community College	Edison, NJ
	Missouri Southern State College	Joplin, MO
	Montana State University	Bozeman, MT
	Muskingum Area Technical College	Zanesville, OH
	Northeastern University	Boston, MA
	Northern Montana College	Havre, MT
	Ohio State University	Columbus, OH
	Operator Training Center	Murfreesboro, TN
	Oregon Institute of Technology	Klamath Falls, OR
	Oscar Rose Junior College	Midwest City, OK
	Purdue University	West Lafayette, IN
	Rensselaer Polytechnic Institute	Troy, NY
	Rice University	Houston, TX
	Rochester Institute of Technology	Rochester, NY
	Rutgers State University of New Jersey	New Brunswick, NJ
	Southern Illinois University	Edwardsville, IL

APPENDIX IV

PARTICIPATING INSTITUTIONS BY ENVIRONMENTAL CATEGORY

CATEGORY	INSTITUTION	LOCATION
POTABLE WATER: (Cont'd)	Springfield Technical Community College	Springfield, MA
	Stanford University	Stanford, CA
	State University of New York at Buffalo	Buffalo, NY
	Stevens Institute of Technology	Hoboken, NJ
	Sumter Technical Community College	Sumter, SC
	Syracuse University	Syracuse, NY
	Temple University	Philadelphia, PA
	Texas State Technical Institute	Waco, TX
	The Pennsylvania State University	University Park, PA
	The Pennsylvania State University/ Capitol Campus	Middletown, PA
	Tufts University	Boston, MA
	Ulster County Community College	Stone Ridge, NY
	University of California-Berkeley	Berkeley, CA
	University of Florida	Gainesville, FL
	University of Hawaii	Honolulu, HI
	University of Iowa	Iowa City, IA
	University of Kansas	Lawrence, KS
	University of Kentucky	Lexington, KY
	University of Maine at Orono	Orono, ME
	University of Michigan	Ann Arbor, MI
	University of Missouri-Columbia	Columbia, MO
	University of Missouri-Rolla	Rolla, MO
	University of Nebraska	Lincoln, NE
	University of North Carolina	Chapel Hill, NC
	University of Pennsylvania	Philadelphia, PA
	University of Pittsburgh	Pittsburgh, PA
	University of Rhode Island	Kingston, RI
	University of Tennessee	Knoxville, TN
	University of Texas-Austin	Austin, TX
	University of Wisconsin-Madison	Madison, WI
	University of Wyoming	Laramie, WY
	Utah State University	Logan, UT
	Vanderbilt University	Nashville, TN
	Virginia Polytechnic Institute and State University	Blacksburg, VA
	Water and Wastewater Technical School	Neosho, MO
	West Georgia College	Carrollton, GA
	West Virginia University	Morgantown, WV
	Wytheville Community College	Wytheville, VA

APPENDIX IV

PARTICIPATING INSTITUTIONS BY ENVIRONMENTAL CATEGORY

CATEGORY	INSTITUTION	LOCATION
RADIATION:	Central Florida Community College	Ocala, FL
	Chattanooga State Technical Community College	Chattanooga, TN
	Columbia University	New York, NY
	Cornell University	Ithaca, NY
	Hartford State Technical College	Hartford, CT
	Harvard University School of Public Health	Boston, MA
	Kansas State University	Manhattan, KS
	Massachusetts Institute of Technology	Cambridge, MA
	Memphis State University	Memphis, TN
	Missouri Southern State College	Joplin, MO
	Oak Ridge Associated Universities	Oak Ridge, TN
	Oklahoma State University	Stillwater, OK
	Rensselaer Polytechnic Institute	Troy, NY
	Rutgers State University of New Jersey	New Brunswick, NJ
	St. Louis Community College at Forest Park	St. Louis, MO
	Southern Technical Institute	Marietta, GA
	The Pennsylvania State University	University Park, PA
	University of Florida	Gainesville, FL
	University of Kansas	Lawrence, KS
	University of Lowell	Lowell, MA
	University of Maryland	College Park, MD
	University of Michigan	Ann Arbor, MI
	University of North Carolina	Chapel Hill, NC
	University of Pittsburgh	Pittsburgh, PA
	University of Tennessee	Knoxville, TN
SOLID WASTE:	Carnegie-Mellon University	Pittsburgh, PA
	Clarkson College	Potsdam, NY
	Cornell University	New York, NY
	Drexel University	Philadelphia, PA
	Hofstra University	Hempstead, NY
	Michigan Technological University	Houghton, MI
	Rensselaer Polytechnic Institute	Troy, NY
	Temple University	Philadelphia, PA
	The Pennsylvania State University	University Park, PA
	University of Iowa	Iowa City, IA
	University of Missouri-Rolla	Rolla, MO
	University of Pittsburgh	Pittsburgh, PA
	Vanderbilt University	Nashville, TN
	West Virginia University	Morgantown, WV
	Wilson County Technical Institute	Wilson, NC
	Yale University	New Haven, CT

APPENDIX IV

PARTICIPATING INSTITUTIONS BY ENVIRONMENTAL CATEGORY

CATEGORY	INSTITUTION	LOCATION
WASTEWATER:	Atlanta University Center/ Georgia Institute of Technology	Atlanta, GA
	Brigham Young University	Provo, UT
	California State University-Sacramento	Sacramento, CA
	Carnegie-Mellon University	Pittsburgh, PA
	Casper College	Casper, WY
	Central Technical Community College	Hastings, NE
	Charles County Community College	La Plata, MD
	Clarkson College	Potsdam, NY
	Clemson University	Clemson, SC
	Colorado State University	Fort Collins, CO
	Community College of Denver-Red Rocks	Golden, CO
	Cornell University	Ithaca, NY
	Delgado College	New Orleans, LA
	Drexel University	Philadelphia, PA
	East Maine Vocational Technical Institute	Bangor, ME
	Greenville Technical College	Greenville, SC
	Harvard University	Cambridge, MA
	Hudson Valley Community College	Troy, NY
	Illinois Institute of Technology	Chicago, IL
	Iowa State University	Ames, IA
	J. Sargeant Reynolds Community College	Richmond, VA
	Kansas State University	Manhattan, KS
	Kirkwood Community College	Cedar Rapids, IA
	Linn-Benton Community College	Albany, OR
	Manhattan College	New York, NY
	Marquette Technical University	Milwaukee, WI
	Massachusetts Institute of Technology	Cambridge, MA
	Miami-Dade Community College	Miami, FL
	Michigan Technological University	Houghton, MI
	Middlesex County College	Edison, NJ
	Missouri Southern State College	Joplin, MO
	Montana State University	Bozeman, MT
	Muskingum Area Technical College	Zanesville, OH
	New England Regional Wastewater Institute	S. Portland, ME
	New Jersey Institute of Technology	Newark, NJ
	Northeastern University	Boston, MA
	Northern Montana College	Havre, MT
	Ohio State University	Columbus, OH
	Operator Training Center	Murfreesboro, TN
	Oregon Institute of Technology	Klamath Falls, OR
	Oscar Rose Junior College	Midwest City, OK

APPENDIX IV

PARTICIPATING INSTITUTIONS BY ENVIRONMENTAL CATEGORY

CATEGORY	INSTITUTION	LOCATION
WASTEWATER: (Cont'd)	Purdue University	West Lafayette, IN
	Rensselaer Polytechnic Institute	Troy, NY
	Rice University	Houston, TX
	Rochester University	Rochester, NY
	Rutgers State University of New Jersey	New Brunswick, NJ
	Southern Illinois University	Edwardsville, IL
	Springfield Technical and Community College	Springfield, MA
	Stanford University	Stanford, CA
	State Technical Institute at Memphis	Memphis, TN
	State University of New York-Buffalo	Buffalo, NY
	Stevens Institute of Technology	Hoboken, NJ
	Sumter Technical Community College	Sumter, SC
	Syracuse University	Syracuse, NY
	Temple University	Philadelphia, PA
	Texas State Technical Institute	Waco, TX
	The Pennsylvania State University	University Park, PA
	The Pennsylvania State University/ Capitol Campus	Middletown, PA
	Tufts University	Boston, MA
	Ulster County Community College	Stone Ridge, NY
	University of California-Berkeley	Berkeley, CA
	University of Florida	Gainesville, FL
	University of Hawaii	Honolulu HI
	University of Kansas	Lawrence, KS
	University of Kentucky	Lexington, KY
	University of Lowell	Lowell, MA
	University of Maine at Orono	Orono, ME
	University of Missouri-Columbia	Columbia, MO
	University of Missouri-Rolla	Rolla, MO
	University of Nebraska	Lincoln, NE
	University of North Carolina	Chapel Hill, NC
	University of Pittsburgh	Pittsburgh, PA
	University of Rhode Island	Kingston, RI
	University of Tennessee	Knoxville, TN
	University of Texas	Austin, TX
	University of Wisconsin-Madison	Madison, WI
	University of Wyoming	Laramie, WY
	Utah State University	Logan, UT
	Vanderbilt University	Nashville, TN
	Virginia Polytechnic Institute and State University	Blacksburg, VA
	Water and Wastewater Technical School	Neosho, MO
	West Georgia College	Carrollton, GA
	West Virginia University	Morgantown, WV
	Wytheville Community College	Wytheville, VA

APPENDIX V

COLLEGE CATALOGS REVIEWED

APPENDIX V
CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
AL	Alabama A & M University	Huntsville
	Alabama Christian College	Montgomery
	Alabama Lutheran Junior College	Selma
	Alexander City State Junior College	Alexander City
	Athens State College	Athens
	Auburn University	Auburn
	Auburn University at Montgomery	Montgomery
	Birmingham-Southern College	Birmingham
	Brewer State Junior College	Fayette
	Enterprise State Junior College	Enterprise
	Faulkner State Junior College	Bay Minette
	Gadsden State Junior College	Gadsden
	George C. Wallace State Community College	Dothan
	George C. Wallace State Community College	Selma
	Jacksonville State University	Jacksonville
	Jefferson Davis State Junior College	Brewton
	Jefferson State Junior College	Birmingham
	John C. Calhoun State Community College	Decatur
	Judson College	Marion
	Livingston University	Livingston
	Lawson State Community College	Birmingham
	Lurleen B. Wallace State Junior College	Andalusia
	Marion Military Institute	Marion
	Miles College	Birmingham
	Mobile College	Mobile
	Northeast Alabama State Junior College	Rainsville
	Northwest Alabama State Junior College	Phil Campbell
	Oakwood College	Huntsville
	Samford University	Birmingham
	Selma University	Selma
	Snead State Junior College	Boaz
	Southeastern Bible College	Birmingham
	Southern Benedictine College	Saint Bernard
	Southern Union State Junior College	Wadley
	Spring Hill College	Mobile
	Stillman College	Tuscaloosa
	Talladega College	Talladega
	Troy State University	Troy
	Tuskeegee Institute	Tuskeegee Institute
	University of Alabama	University
	University of Alabama in Birmingham	Birmingham
	University of Alabama in Huntsville	Huntsville
	University of Montevallo	Montevallo
	University of North Alabama	Florence
	University of South Alabama	Mobile
	Walker College	Jasper
AK	Sheldon Jackson College	Sitka
	University of Alaska-Fairbanks	Fairbanks
	University of Alaska Juneau Senior College	Juneau
AS	American Samoa Community College	Pago Pago
AZ	American Graduate School of International Management	Glendale
	Arizona State University	Tempe
	Arizona Western College	Yuma

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Central Arizona College	Coolidge
	Cochise College	Douglas
	College of Ganado	Ganado
	DeVry Institute of Technology	Phoenix
	Eastern Arizona College	Thatcher
	Grand Canyon College	Phoenix
	Maricopa County Community College System Office	Phoenix
	Glendale Community College	Glendale
	Maricopa Technical Community College	Phoenix
	Mesa Community College	Mesa
	Phoenix College	Phoenix
	Scottsdale Community College	Scottsdale
	Mohave Community College	Kingman
	Navajo Community College	Tsaile
	Northern Arizona University	Flagstaff
	Northland Pioneer College	Holbrook
	Pima Community College	Tucson
	Southwestern College	Phoenix
	University of Arizona	Tucson
	Yavapai College	Prescott
AR	Arkansas College	Batesville
	Arkansas State University-Main Campus	State University
	Arkansas State University-Beebe Branch	Beebe
	Arkansas Tech University	Russellville
	Central Baptist College	Conway
	College of the Ozarks	Clarksville
	Crowley's Ridge College	Paragould
	Garland County Community College	Hot Springs
	Harding College-Main Campus	Searcy
	Henderson State University	Arkadelphia
	Hendrix College	Conway
	John Brown University	Siloam Springs
	Mississippi County Community College	Blytheville
	Quachita Baptist University	Arkadelphia
	Philander Smith College	Little Rock
	Phillips County Community College	Helena
	Southern Arkansas University	Magnolia
	Southern Arkansas University Southwest Technical Institute	East Camden
	Southern Baptist College	Walnut Ridge
	Southern State College	Magnolia
	University of Arkansas-Main Campus	Fayetteville
	University of Arkansas-Little Rock	Little Rock
	University of Arkansas Medical Sciences Campus	Little Rock
	University of Arkansas-Monticello	Monticello
	Westlark Community College	Fort Smith
CA	Allan Hancock College	Santa Maria
	Ambassador College	Pasadena
	American Baptist Seminary of the West-Central Office	Berkeley
	American Baptist Seminary of the West-Covina	Covina
	Armstrong College	Berkeley
	Azusa Pacific College	Azusa
	Bakersfield College	Bakersfield
	Barstow College	Barstow
	Bauder College	Sacramento
	Bethany Bible College	Santa Cruz
	Biola College	La Mirada
	Brooks College	Long Beach

APPENDIX V
CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Brooks Institute of Santa Barbara	Santa Barbara
	Butte College	Oroville
	Cabrillo College	Aptos
	California Baptist College	Riverside
	California College of Arts and Crafts	Oakland
	California Institute of the Arts	Valencia
	California Institute of Asian Studies	San Francisco
	California Institute of Technology	Pasadena
	California Lutheran College	Thousand Oaks
	California Maritime Academy	Vallejo
	California State College-San Bernadino	San Bernardino
	California State College-Stanislaus	Turlock
	California Polytechnic State University-San Luis Obispo	San Luis Obispo
	California State University-Fresno	Fresno
	California State University-Fullerton	Fullerton
	California State University-Hayward	Hayward
	California State University-Long Beach	Long Beach
	California State University-Los Angeles	Los Angeles
	California State University-Sacramento	Sacramento
	San Diego State University	San Diego
	San Jose State University	San Jose
	Cerritos College	Norwalk
	Cerro Coso Community College	Ridgecrest
	Chapman College	Orange
	Christian Heritage College	El Cajon
	Church Divinity School of the Pacific	Berkeley
	Citrus College	Azusa
	Claremont Colleges-System Office	Claremont
	Claremont Men's College	Claremont
	Claremont University Center and Graduate School	Claremont
	Harvey Mudd College	Claremont
	Pitzer College	Claremont
	Pomona College	Claremont
	Scripps College	Claremont
	Coast Community College-System Office	Costa Mesa
	Golden West College	Huntington Beach
	Orange Coast College	Costa Mesa
	Cogswell College	San Francisco
	Colegio De La Tierra	Goshen
	College of the Canyons	Valencia
	College of the Desert	Palm Desert
	College of Marin	Kentfield
	College of Notre Dame	Belmont
	College of the Redwoods	Eureka
	College of the Siskiyous	Weed
	Columbia Junior College	Columbia
	Compton Community College	Compton
	Contra Costa Community College-System Office	
	Diablo Valley College	Pleasant Hill
	Cuesta College	San Luis Obispo
	Cypress College	Cypress
	Dominican College of San Rafael	San Rafael
	El Camino College	Torrance
	Foothill-De Anza Community College District-System Office	Los Altos Hills
	De Anza College	Cupertino
	Foothill College	Los Altos Hills
	Fuller Theological Seminary	Pasadena
	Gavilan College	Gilroy
	Glendale Community College	Glendale
	Golden Gate University	San Francisco
	Grossmont College	El Cajon
	Hartnell College	Salinas
	Holy Family College	Mission San Jose

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Holy Names College	Oakland
	Immaculate Heart College	Los Angeles
	Indian Valley Colleges	Novato
	John F. Kennedy University	Orinda
	Lake Tahoe Community College	S. Lake Tahoe
	Lassen College	Susanville
	LaVerne College	La Verne
	L.I.F.E. Bible College	Los Angeles
	Lincoln University	San Francisco
	Lone Mountain College	San Francisco
	Long Beach City College	Long Beach
	Los Angeles Baptist College	Newhall
	Los Angeles Community College-System Office	Los Angeles
	East Los Angeles College	Los Angeles
	Los Angeles City College	Los Angeles
	Los Angeles Harbor College	Wilmington
	Los Angeles Mission College	San Fernando
	Los Angeles Pierce College	Woodland Hills
	Los Angeles Southwest College	Los Angeles
	Los Angeles Valley College	Van Nuys
	West Los Angeles College	Culver City
	Los Rios Community College-System Office	Sacramento
	Cosumnes River College	Sacramento
	Sacramento City College	Sacramento
	Loyla Marymount University	Los Angeles
	Marymount Palos Verdes College	Rancho Palos Verdes
	Mendocino College	Ukiah
	Menlo College	Menlo Park
	Mennonite Brethren Biblical Seminary	Fresno
	Merced College	Merced
	Mills College	Oakland
	Monterey Institute for Foreign Studies	Monterey
	Monterey Peninsula College	Monterey
	Mount San Antonio College	Walnut
	Mount San Jacinto College	San Jacinto
	Napa College	Napa
	National University	San Diego
	New College of California	San Francisco
	Northrop University	Inglewood
	Occidental College	Los Angeles
	Ohlone College	Fremont
	Otis Art Institute of Los Angeles County	Los Angeles
	Pacific Christian College	Fullerton
	Pacific College	Fresno
	Pacific Oaks College	Pasadena
	Pacific School of Religion	Berkeley
	Pacific Union College	Angwin
	Palomar College	San Marcos
	Palo Verde College	Blythe
	Pasadena City College	Pasadena
	Patten Bible College	Oakland
	Pepperdine University	Malibu
	Peralta Community Colleges-System Office	Oakland
	College of Alameda	Alameda
	Point Loma College	San Diego
	Porterville College	Porterville
	Rand Graduate Institute of Policy Studies	Santa Monica
	Riverside City College	Riverside
	Rosemead Graduate School of Psychology	Rosemead
	Saddleback Community College	Mission Viejo
	Saint Mary's College of California	Moraga

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Saint Patrick's College	Mountain View
	San Diego Community College-Central Office	San Diego
	San Diego Community College-City College	San Diego
	San Diego Community College-Evening College	
	San Francisco Art Institute	San Francisco
	San Francisco Conservatory of Music	San Francisco
	San Francisco Theological Seminary	San Anselmo
	San Joaquin Delta College	Stockton
	San Jose Community College District-	
	Evergreen Valley College	San Jose
	San Jose City College	San Jose
	San Mateo County Community College District-System Office	San Mateo
	Canada College	Redwood City
	College of San Mateo	San Mateo
	Skyline College	San Bruno
	Santa Ana College	Santa Ana
	Santa Barbara City College	Santa Barbara
	Santa Monica College	Santa Monica
	Santa Rosa Junior College	Santa Rosa
	Shasta College	Redding
	Sierra College	Rocklin
	Simpson College	San Francisco
	Solano Community College	Suisun City
	Southern California College	Costa Mesa
	Southern California College of Optometry	Fullerton
	Southwestern University School of Law	Los Angeles
	Stanford University	Stanford
	State Center Community College District	
	Fresno City College	Fresno
	Reedley College	Reedley
	Taft College	Taft
	United States International University	San Diego
	University of California-Berkeley	Berkeley
	University of California-Davis	Davis
	University of California Hastings College of Law	San Francisco
	University of California-Irvine	Irvine
	University of California-Los Angeles	Los Angeles
	University of California-Riverside	Riverside
	University of California-San Francisco	San Francisco
	University of California-Santa Barbara	Santa Barbara
	University of the Pacific	Stockton
	University of Redlands	Redlands
	University of San Diego	San Diego
	University of San Francisco	San Francisco
	University of Santa Clara	Santa Clara
	University of Southern California	Los Angeles
	University of West Los Angeles	Culver City
	Ventura County Community College District	
	Moorpark College	Moorpark
	Oxnard College	Oxnard
	Ventura College	Ventura
	West Coast Bible College	Fresno
	West Coast University Central Office	Los Angeles
	West Coast University Orange County Center	Orange
	Western State University College of Law-Orange County	Fullerton
	Western State University College of Law-San Diego	San Diego
	West Hills College	Coalinga
	Westmont College	Santa Barbara
	West Valley College	Saratoga

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Whittier College	Whittier
	Woodbury University	Los Angeles
	The Wright Institute	Berkeley
	Yuba College	Marysville
CO	Adams State College	Alamosa
	Aims Community College	Greeley
	Arapahoe Community College	Littleton
	Colorado College	Colorado Springs
	Colorado Mountain College-East Campus	Leadville
	Colorado Mountain College-West Campus	Glenwood Springs
	Colorado School of Mines	Golden
	Colorado State University	Fort Collins
	Colorado Technical College	Manitou Springs
	Colorado Women's College	Denver
	Community College of Denver-Auraria Campus	Denver
	Community College of Denver-North Campus	Denver
	Community College of Denver-Red Rocks Campus	Golden
	Conservative Baptist Theological Seminary	Denver
	El Paso Community College	Colorado Springs
	Fort Lewis College	Durango
	Iliff School of Theology	Denver
	Lamar Community College	Lamar
	Loretto Heights College	Denver
	Mesa College	Grand Junction
	Metropolitan State College	Denver
	Morgan Community College	Fort Morgan
	Northeastern Junior College	Sterling
	Ortero Junior College	La Junta
	Regis College	Denver
	Rockmont College	Denver
	Saint Thomas Seminary	Denver
	Trinidad State Junior College	Trinidad
	University of Colorado-Boulder	Boulder
	University of Colorado-Colorado Springs	Colorado Springs
	University of Colorado-Denver	Denver
	University of Denver	Denver
	University of Denver College of Law	Denver
	University of Northern Colorado	Greeley
	University of Southern Colorado	Pueblo
	Western Bible College	Morrison
	Western State College of Colorado	Gunnison
CT	Albertus Magnus College	New Haven
	Annhurst College	Woodstock
	Bridgeport Engineering Institute	Bridgeport
	Connecticut College	New London
	Eastern Connecticut State College	Willimmatic
	Greater Hartford Community College	Hartford
	Hartford State Technical College	Hartford
	Housatonic Regional Community College	Bridgeport
	Mattuck Community College	Waterbury
	Middlesex Community College	Middletown
	Mitchell College	New London
	Mohegan Community College	Norwich
	Northwestern Connecticut Community College	Winsted
	Norwalk Community College	Norwald
	Post Junior College	Waterbury
	Quinebaug Valley Community College	Danielson
	Saint Joseph College	West Hartford

APPENDIX V
CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Thames Valley State Technical College	Norwich
	Trinity College	Hartford
	Tunxis Community College	Farmington
	University of Bridgeport	Bridgeport
	University of Hartford	West Hartford
	University of New Haven	West Haven
	Yale University	New Haven
DE	Delaware State College	Dover
	Delaware Technical and Community College	Dover
	Goldey Beacom College	Wilmington
	University of Delaware	Newark
	Wesley College	Dover
DC	American University	Washington
	Catholic University of America	Washington
	District of Columbia Teachers College	Washington
	Gallaudet College	Washington
	George Washington University	Washington
	Howard University	Washington
	Mount Vernon College	Washington
	Trinity College	Washington
FL	Barry College	Miami
	Brevard Community College	Cocoa
	Broward Community College	Fort Lauderdale
	Central Florida Community College	Ocala
	Chipola Junior College	Marianna
	College of Boca Raton	Boca Raton
	Daytona Beach Community College	Daytona Beach
	Eckerd College	St. Petersburg
	Edison Community College	Fort Meyers
	Embry-Riddle Aeronautical University	Daytona Beach
	Flagler College	St. Augustine
	Florida A & M University	Tallahassee
	Florida Atlantic University	Boca Raton
	Florida College	Temple Terrace
	Florida International University	Miami
	Florida Junior College	Jacksonville
	Florida Keys Community College	Key West
	Florida Southern College	Lakeland
	Florida Technological University	Orlando
	Fort Lauderdale College	Fort Lauderdale
	Gulf Coast Community College	Panama City
	Heed University	Hollywood
	Hillsborough Community College	Tampa
	Indian River Community College	Fort Pierce
	Jacksonville University	Jacksonville
	Jones College	Jacksonville
	Lake City Community College	Lake City
	Lake-Sumter Community College	Leesburg
	Manatee Junior College	Bradenton
	Miami Christian College	Miami
	Miami-Dade Community College	Miami
	North Florida Junior College	Madison
	Nova University	Fort Lauderdale
	Okaloosa-Walton Junior College	Niceville
	Palm Beach Atlantic College	West Palm Beach
	Palm Beach Junior College	Lake Worth
	Pensacola Junior College	Pensacola
	Polk Community College	Winter Haven

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Rollins College	Winter Park
	Saint Johns River Junior College	Palatka
	Saint Leo College	Saint Leo
	Santa Fe Community College	Gainesville
	Seminole Community College	Sanford
	South-Eastern Bible College	Lakeland
	South Florida Junior College	Avon Park
	University of Florida	Gainesville
	University of Miami	Coral Gables
	University of North Florida	Jacksonville
	Warner Southern College	Lake Wales
	Webber College	Babson Park
GA	Abraham Baldwin Agricultural College	Tifton
	Agnes Scott College	Decatur
	Albany Area Vocational Technical School	Albany
	Albany Junior College	Albany
	Albany State College	Albany
	Andrew College	Cuthbert
	Armstrong State College	Savannah
	Atlanta Christian College	East Point
	Atlanta Junior College	Atlanta
	Atlanta University	Atlanta
	Augusta College	Augusta
	Bainbridge Junior College	Bainbridge
	Berry College	Mount Berry
	Brenau College	Gainesville
	Brewton-Parker College	Mount Vernon
	Carroll County Area Vocational-Technical School	Carrollton
	Carver Bible Institute and College	Atlanta
	Clark College	Atlanta
	Clayton Junior College	Morrow
	Columbus College	Columbus
	Dalton Junior College	Dalton
	DeKalb Community College	Clarkston
	Emanuel County Junior College	Swainsboro
	Emory University	Atlanta
	Fort Valley State College	Fort Valley
	Gainesville Junior College	Gainesville
	Georgia College	Milledgeville
	Georgia Institute of Technology	Atlanta
	Georgia Military College	Milledgeville
	Georgia Southern College	Statesboro
	Georgia Southwestern College	Americus
	Georgia State University	Atlanta
	Gordon Junior College	Barnesville
	Kennesaw Junior College	Marietta
	LaGrange College	LaGrange
	Macon Junior College	Macon
	Marietta-Cobb Area Vocational Technical School	Marietta
	Mercer University	Macon
	Mercer University in Atlanta	Atlanta
	Middle Georgia College	Cochran
	Morehouse College	Atlanta
	Moultrie Area Vocational-Technical School	Moultrie
	North Georgia College	Dahlonega
	North Georgia Technical and Vocational School	Clarkesville
	Oglethorpe College	Atlanta
	Pickens Area Vocational-Technical School	Jasper
	Piedmont College	Demorest
	Reinhardt College	Waleska

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Savannah Area Vocational Technical School	Savannah
	Savannah State College	Savannah
	Shorter College	Rome
	South Georgia College	Douglas
	South Georgia Technical and Vocational School	Americus
	Southern Technical Institute	Marietta
	Swainsboro Area Vocational-Technical School	Swainsboro
	Thomas Area Vocational-Technical School	Thomasville
	Tift College	Forsyth
	Toccoa Falls College	Toccoa Falls
	Troup County Area Vocational Technical School	LaGrange
	Truett McConnell College	Cleveland
	University of Georgia	Athens
	Upson County Area Vocational-Technical School	Thomaston
	Valdosta State College	Valdosta
	Valdosta Technical School	Valdosta
	Walker County Area Technical School	Rock Spring
	Waycross-Ware Area Technical School	Waycross
	Wesleyan College	Macon
	West Georgia College	Carrollton
	Young Harris College	Young Harris
HI	Brigham Young University-Hawaii Campus	Laie Oahu
	Chaminade College of Honolulu	Honolulu
	Hawaii Pacific College	Honolulu
	University of Hawaii-Honolulu Community College	Honolulu
	University of Hawaii-Kapiolani Community College	Honolulu
	University of Hawaii-Kauai Community College	Lihue
	University of Hawaii-Leeward Community College	Pearl City
	University of Hawaii-Manoa	Honolulu
	University of Hawaii-Maui Community College	Kahului
	University of Hawaii-Windward Community College	Kaneohe
ID	Boise State University	Boise
	College of Southern Idaho	Twin Falls
	Idaho State University	Pocatello
	North Idaho College	Coeur D'Alene
	Northwest Nazarene College	Nampa
	Ricks College	Rexburg
	University of Idaho	Moscow
IL	Augustana College	Rock Island
	Aurora College	Aurora
	Barat College	Lake Forest
	Belleville Area College	Belleville
	Blackburn College	Carlinville
	Black Hawk College	Moline
	Bradley University	Peoria
	Carl Sandburg College	Galesburg
	Central YMCA Community College	Chicago
	Chicago College of Osteopathic Medicine	Chicago
	Chicago State University	Chicago
	College of DuPage	Glen Ellyn

APPENDIX V
CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	College of Lake County	Grayslake
	College of St. Francis	Joliet
	College of the University of Chicago	Chicago
	Danville Junior College	Danville
	DeLourdes College	Des Plaines
	DePaul University	Chicago
	DeVry Institute of Technology	Chicago
	Eastern Illinois University	Charleston
	Elgin Community College	Elgin
	Elmhurst College	Elmhurst
	Eureka College	Eureka
	George Williams College	Downers Grove
	Governors State University	Park Forest South
	Greenville College	Greenville
	Highland Community College	Freeport
	Illinois Benedictine College	Lisle
	Illinois Central College	East Peoria
	Illinois College	Jacksonville
	Illinois College of Optometry	Chicago
	Illinois College of Podiatric Medicine	Chicago
	Illinois Institute of Technology	Chicago
	Illinois State University	Normal
	Illinois Valley Community College	Oglesby
	Illinois Wesleyan University	Bloomington
	Joliet Junior College	Joliet
	Judson College	Elgin
	Kankakee Community College	Kankakee
	Kendall College	Evanston
	Kishwaukee College	Malta
	Knox College	Galesburg
	Lake Forest College	Evanston
	Lakeland College	Mattoon
	Lewis and Clark Community College	Godfrey
	Lincoln Trail College	Robinson
	Logan (John A.) College	Carterville
	Loyola University of Chicago	Chicago
	MacMurray College	Jacksonville
	McHenry County College	Crystal Lake
	McKendree College	Lebanon
	Meadville Theological School	Lombard
	Millikin University	Decatur
	Moraine Valley Community College	Palos Hills
	National College of Chiropractic	Lombard
	North Central College	Naperville
	Northeastern Illinois University	Chicago
	Northern Baptist Theological Seminary	Lombard
	Northern Illinois University	DeKalb
	Northwestern University	Evanston
	Oakton Community College	Morton Grove
	Olivet Nazarene College	Kankakee
	Olney Central College	Mt. Carmel
	Prairie State Community College	Chicago Heights
	Rockford College	Rockford
	Rock Valley College	Rockford
	Roosevelt University	Chicago
	Rush University, College of Nursing and Allied Health Sciences	Chicago
	Rush University, Rush Medical College	Chicago
	Sangamon State University	Springfield
	Sauk Valley College	Dixon
	Southern Illinois University	Carbondale
	Southern Illinois University	Edwardsville
	Spertus College of Judaica	Chicago
	Spoon River College	Canton
	Springfield College in Illinois	Springfield

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	State Community College of East Saint Louis, Illinois	East St. Louis
	Thornton Community College	South Holland
	Triton College	River Grove
	University of Health Sciences, The Chicago Medical School	Chicago
	University of Illinois at Chicago Circle	Chicago
	University of Illinois at the Medical Center, School of Public Health	Chicago
	University of Illinois at Urbana-Champaign	Urbana-Champaign
	Wabash Valley College	Mt. Carmel
	Waubonsee Community College	Sugar Grove
	Western Illinois University	Macomb
	Wheaton College	Wheaton
	William Rainey Harper College	Palatine
IN	Anderson College	Anderson
	Associated Mennonite Biblical Seminary	Elkhart
	Ball State University	Muncie
	Bethel College	Mishawaka
	Butler University	Indianapolis
	DePauw University	Greencastle
	Earlham College	Richmond
	Franklin College	Franklin
	Goshen College	Goshen
	Grace College	Winona Lake
	Hanover College	Hanover
	Holy Cross Junior College	Notre Dame
	Huntington College	Huntington
	Indiana Central College	Indianapolis
	Indiana Institute of Technology	Fort Wayne
	Indiana State University	Evansville
	Indiana University	Bloomington
	Indiana University-East	Richmond
	Indiana University-Kokomo	Kokomo
	Indiana University-Northwest	Gary
	Indiana University-South Bend	South Bend
	Indiana University-Southeast	New Albany
	Indiana University-Purdue University at Fort Wayne	Fort Wayne
	Indiana Vocational Technical College	Indianapolis
	International Junior College	Fort Wayne
	Manchester College	North Manchester
	Marian College	Indianapolis
	Marion College	Marion
	Oakland College	Oakland City
	Purdue State University	Muncie
	Purdue University	West Lafayette
	Purdue University-Calumet	Calumet
	Purdue University-North Central	Westville
	Rose-Hulman Institute of Technology	Terre Haute
	Saint Joseph's College	Rensselaer
	Saint Mary's College	Notre Dame
	Saint Mary of the Woods College	Saint Mary of the Woods
	Saint Meinard College	St. Meinard
	Taylor University	Upland
	Tri-State University	Angola
	University of Evansville	Evansville
	University of Notre Dame	South Bend
	Valparaiso University	Valparaiso
	Vincennes University	Vincennes
	Wabash College	Crawfordsville

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
IA	Area One Vocational-Technical School	Calmar and Dubuque
	Briar Cliff College	Sioux City
	Central College	Pella
	Clarke College	Dubuque
	Coe College	Cedar Rapids
	Cornell College	Mt. Vernon
	Des Moines Area Community College	Ankeny
	Drake University	Des Moines
	Ellsworth Community College	Iowa Falls
	Grinnell College	Grinnell
	Hawkeye Institute of Technology	Waterloo
	Iowa Central Community College	Fort Dodge
	Iowa Lakes Community College	Estherville
	Iowa State University	Ames
	Iowa Wesleyan College	Mount Pleasant
	Iowa Western Community College	Council Bluffs
	Kirkwood Community College	Cedar Rapids
	Loras College	Dubuque
	Luther College	Decorah
	Marshalltown Community College	Marshalltown
	Marycrest College	Davenport
	Morningside College	Sioux City
	Mount Mercy College	Cedar Rapids
	North Iowa Area Community College	Mason City
	Open Bible College	Des Moines
	Palmer College of Chiropractic	Davenport
	Simpson College	Indianola
	Southeastern Community College	Burlington
	Southwestern Community College	Creston
	University of Dubuque	Dubuque
	University of Dubuque Theological Seminary	Dubuque
	University of Iowa	Iowa City
	University of Northern Iowa	Cedar Falls
	Upper Iowa University	Fayette
	Wartburg College	Waverly
	Wartburg Seminary	Dubuque
	Westmar College	LeMars
	Western Iowa Technical Community College	Sioux City
KS	Allen County Community Junior College	Iola
	Baker University	Baldwin
	Barton County Community College	Great Bend
	Benedictine College	Atchison
	Bethel College	North Newton
	Central College	McPherson
	Cloud County Community College	Concordia
	Coffeyville Community Junior College	Coffeyville
	Colby Community College	Colby
	Cowley County Community College	Arkansas City
	Dodge City Community College	Dodge City
	Donnelly College	Kansas City
	Emporia Kansas State College	Emporia
	Fort Hays Kansas State College	Hays
	Fort Scott Community College	Fort Scott
	Friends Bible College	Haviland
	Garden City Community College	Garden City
	Haskell Indian Junior College	Lawrence
	Hesston College	Hesston
	Highland Community Junior College	Highland
	Hutchinson Community Junior College	Hutchinson
	Independence Community Junior College	Independence
	Johnson County Community College	Overland Park
	Kansas City Community College	Kansas City

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Kansas Newman College	Wichita
	Kansas State College of Pittsburg	Pittsburg
	Kansas State University	Manhattan
	Kansas Technical Institute	Salina
	Kansas Wesleyan	Salina
	Labette Community Junior College	Parsons
	Manhattan Christian College	Manhattan
	Marymount College of Kansas	Salina
	McPherson College	McPherson
	Mid-America Nazarene College	Olathe
	Neosho County Community Junior College	Chanute
	Ottawa University	Ottawa
	Pratt Community College	Pratt
	Saint John's College	Winfield
	Saint Mary College	Leavenworth
	Saint Mary of the Plains College	Dodge City
	Seward County Community College	Liberal
	Southwestern College in Kansas	Winfield
	Sterling College	Sterling
	Tabor College	Hillsboro
	The University of Kansas	Lawrence
	Washburn University of Topeka	Topeka
	Wichita State University	Wichita
KY	Alice Lloyd College	Pippa Passes
	Asbury College	Wilmore
	Bellarmine College	Louisville
	Berea College	Berea
	Brescia College	Owensboro
	Campbellsville College	Campbellsville
	Centre College of Kentucky	Danville
	Cumberland College	Williamsburg
	Eastern Kentucky University	Richmond
	Georgetown College	Georgetown
	Jefferson Vocational Regional Office	Jeffersontown
	Kentucky Christian College	Grayson
	Kentucky State University	Frankfort
	Kentucky Wesleyan College	Owensboro
	Lees Junior College	Jackson
	Lindsey Wilson College	Columbia
	Midway College	Midway
	Morehead State University	Morehead
	Murray State University	Murray
	Pikeville College	Pikeville
	Saint Catharine College	Saint Catharine
	Southeastern Christian College	Winchester
	Sue Bennett College	London
	Thomas More College	Fort Mitchell
	Transylvania University	Lexington
	University of Kentucky	Lexington
	University of Kentucky Community College System	Lexington
	University of Louisville	Louisville
	Western Kentucky University	Bowling Green
LA	Bossier Parish Community College	Bossier City
	Centenary College of Louisiana	Shreveport
	Delgado College	New Orleans
	Dillard University	New Orleans
	Grambling State University	Grambling
	Louisiana State University-Central Office	Baton Rouge

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Louisiana State University and Agricultural and Mechanical College at Baton Rouge	Baton Rouge
	Louisiana State University-Alexandria	Alexandria
	Louisiana State University-Eunice	Eunice
	Louisiana State University-Shreveport	Shreveport
	University of New Orleans	New Orleans
	Louisiana Tech University	Ruston
	McNeese State University	Lake Charles
	New Orleans Baptist Theological Seminary	New Orleans
	Northeast Louisiana University	Monroe
	Northwestern State University of Louisiana	Natchitoches
	Notre Dame Seminary School of Theology	New Orleans
	Our Lady of Holy Cross College	New Orleans
	Saint Bernard Parish Community College	Chalmette
	Saint Joseph Seminary College	Saint Benedict
	Saint Mary's Dominican College	New Orleans
	Southern University in New Orleans	New Orleans
	Tulane University of Louisiana	New Orleans
	Xavier University of Louisiana	New Orleans
ME	Bowdoin College	Brunswick
	Colby College	Waterville
	College of the Atlantic	Bar Harbor
	Eastern Maine Vocational and Technical Institute	Bangor
	Maine Maritime Academy	Castine
	Masson College	Springvale
	South Maine Vocational and Technical Institute	South Portland
	Unity College	Unity
	University of Maine at Orono	Orono
MD	Bowie State College	Bowie
	Catonsville Community College	Catonsville
	Charles County Community College	La Plata
	Chesapeake College	Wye Mills
	Columbia Union College	Takoma Park
	Community College of Baltimore	Baltimore
	Dundalk Community College	Baltimore
	Essex Community College	Baltimore County
	Garrett Community College	McHenry
	Goucher College	Towson
	Hagerstown Junior College	Hagerstown
	Harford Community College	Bel Air
	Hood College	Frederick
	Howard Community College	Columbia
	Johns Hopkins University	Baltimore
	Loyola College	Baltimore
	Montgomery College	Rockville
	Saint John's College	Annapolis
	Saint Mary's College of Maryland	Saint Mary's City
	Towson State College	Baltimore
	University of Baltimore	Baltimore
	University of Maryland	College Park
	Villa Julie College	Stevenson
	Washington College	Chestertown

APPENDIX V
CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
MA	Amherst College	Amherst
	Anna Maria College	Paxton
	Assumption College	Worcester
	Bay Path Junior College	Longmeadow
	Bentley College	Waltham
	Boston College	Chestnut Hill
	Boston University	Boston
	Gordon College	Wenham
	Hampshire College	Amherst
	Harvard University	Cambridge
	Lasell Junior College	Auburndale
	Lesley College	Cambridge
	Massachusetts Institute of Technology	Cambridge
	Merrimack College	North Andover
	Mount Holyoke College	South Hadley
	Nichols College	Dudley
	Northeastern University	Boston
	Regis College	Weston
	Simon's Rock	Great Barrington
	Smith College	Northampton
	Southeastern Massachusetts University	North Darmouth
	Springfield College	Springfield
	Springfield Technical Community College	Springfield
	Stonehill College	North Easton
	Suffolk University	Boston
	Tufts University	Medford
	University of Massachusetts	Boston
	Wentworth Institute	Boston
	Wheelock College	Boston
	Williams College	Williamstown
	Worcester Junior College	Worcester
	Worcester Polytechnic Institute	Worcester
MI	Alma College	Alma
	Alpena Community College	Alpena
	Andrews University	Berrien Springs
	Aquinas College	Grand Rapids
	Bay de Noc Community College	Escanaba
	Calvin College	Grand Rapids
	Calvin Theological Seminary	Grand Rapids
	Central Michigan University	Mount Pleasant
	Concordia Lutheran Junior College	Ann Arbor
	Delta College	University Center
	Detroit Institute of Technology	Detroit
	Eastern Michigan University	Ypsilanti
	Ferris State College	Big Rapids
	General Motors Institute	Flint
	Grace Bible College	Wyoming
	Grand Rapids Baptist College	Grand Rapids
	Grand Rapids Junior College	Grand Rapids
	Grand Valley State College	Allendale
	Highland Park Community College	Highland Park
	Hillsdale College	Hillsdale
	Hope College	Holland

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Jackson Community College	Jackson
	Kalamazoo College	Kalamazoo
	Kalamazoo Valley Community College	Kalamazoo
	Kirtland Community College	Roscommon
	Lake Michigan College	Benton Harbor
	Lake Superior State College	Saulte Ste. Marie
	Lansing Community College	Lansing
	Macomb County Community College	Warren
	Madonna College	Livonia
	Marygrove College	Detroit
	Mercy College of Detroit	Detroit
	Merrill-Palmer Institute	Detroit
	Michigan Department of Education-Environmental Guidelines	Lansing
	Michigan State University	East Lansing
	Michigan Technological University	Houghton
	Mid Michigan Community College	Harrison
	Monroe County Community College	Monroe
	Montcalm Community College	Sidney
	Mott Community College	Flint
	Muskegon Business College	Muskegon
	Muskegon Community College	Muskegon
	Northern Michigan University	Marquette
	Northwestern Michigan College	Traverse City
	Oakland Community College	Bloomfield Hills
	Oakland University	Rochester
	Olivet College	Olivet
	Saginaw Valley State College	University Center
	Saint Mary's College	Orchard Lake
	Schoolcraft College	Livonia
	Shaw College at Detroit	Detroit
	Southwestern Michigan College	Dowagiac
	Spring Arbor College	Spring Arbor
	Suomi College	Hancock
	University of Detroit	Detroit
	University of Michigan	Ann Arbor
	Walsh College	Troy
	Washtenaw Community College	Ann Arbor
	Wayne County Community College	Detroit
	Wayne State University	Detroit
	Western Michigan University	Kalamazoo
	West Shore Community College	Scottville
	Western Theological Seminary	Holland
MN	Anoka-Ramsey Community College	Coon Rapids
	Augsburg College	Minneapolis
	Austin Community College	Austin
	Bemidji State University	Bemidji
	Bethany Lutheran College	Mankato
	Brainerd Community College	Brainerd
	Carleton College	Northfield
	College of Saint Benedict	St. Joseph
	College of St. Catherine	St. Paul
	College of St. Scholastica	Duluth
	College of St. Thomas	St. Paul
	Concordia College	Moorhead
	Crosier Seminary Junior College	Onamia
	Dr. Martin Luther College	New Ulm
	Fergus Falls Community College	Fergus Falls
	Hibbing Community College	Hibbing
	Itasca Community College	Grand Rapids
	Lakewood Community College	White Bear Lake
	Luther Theological Seminary	St. Paul
	Macalester College	St. Paul
	Mankato State University	Mankato

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Mesabi Community College	Virginia
	Metropolitan Community College	Minneapolis
	Metropolitan State University	St. Paul
	Minneapolis College of Art and Design	Minneapolis
	Minnesota Bible College	Rochester
	Moorhead State College	Moorhead
	Normandale Community College	Bloomington
	North Hennepin Community College	Minneapolis
	Northland Community College	Thief River Falls
	Northwestern College	Roseville
	Rainy River Community College	International Falls
	Rochester Community College	Rochester
	Saint John's University	Collegeville
	Saint Mary's College	Winona
	Southwest Minnesota State College	Marshall
	St. Cloud Area Vocational Technical Institute	St. Cloud
	St. Cloud State University	St. Cloud
	St. Mary's Junior College	Minneapolis
	St. Paul Bible College	Bible College
	United Theological Seminary of the Twin Cities	New Brighton
	University of Minnesota	Minneapolis
	Vermilion Community College	Ely
	William Mitchell College of Law	St. Paul
	Winona State University	Winona
	Worthington Community College	Worthington
MS	Alcorn State University	Lorman
	Belhaven College	Jackson
	Clarke College	Newton
	Coahama Junior College	Clarksdale
	Copiah-Lincoln Junior College	Wesson
	Delta State University	Cleveland
	East Central Junior College	Decatur
	East Mississippi Junior College	Scooba
	Hinds Junior College	Raymond
	Holmes Junior College	Goodman
	Itawamba Junior College	Fulton
	Jackson State University	Jackson
	John C. Stennis Vocational Complex	Dekalb
	Jones County Junior College	Ellisville
	Mary Holmes College	West Point
	Meridian Junior College	Meridian
	Millsaps College	Jackson
	Mississippi College	Clinton
	Mississippi Delta Junior College	Moorhead
	Mississippi Gulf Coast Junior College	Perkinston
	Mississippi Industrial College	Holly Springs
	Mississippi State University	Mississippi State
	Mississippi University for Women	Columbus
	Northeast Mississippi Junior College	Booneville
	Northwest Mississippi Junior College	Senatobia
	Pearl River Junior College	Poplarville
	Rust College	Holly Springs
	Southwest Mississippi Junior College	Summit
	Tougaloo College	Tougaloo
	University of Mississippi	University
	University of Mississippi Medical Center	Jackson
	University of Southern Mississippi	Hattiesburg
	Utica Junior College	Utica
	Wesley College	Florence
	William Carey College	Hattiesburg
	Wood Junior College	Mathiston

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
MO	Assemblies of God Graduate School	Springfield
	Avila College	Kansas City
	Calvary Bible College	Kansas City
	Central Bible College	Springfield
	Central Methodist College	Fayette
	Central Missouri State University	Warrensburg
	Columbia College	Columbia
	Concordia Seminary	St. Louis
	Cottey College	Nevada
	Crowder College	Neosho
	Culver-Stockton College	Canton
	Fontbonne College	St. Louis
	Hannibal Lagrange College	Hannibal
	Harris Teachers College	St. Louis
	Jefferson College	Hillsboro
	Kansas City Art Institute	Kansas City
	Kansas City College of Osteopathic Medicine	Kansas City
	Logan College of Chiropractic	Chesterfield
	Longview Community College	Kansas City
	Maple Woods Community College	Kansas City
	Maryville College	St. Louis
	Meramec Community College	St. Louis
	Missouri Baptist College	St. Louis
	Missouri Southern State College	Joplin
	Moberly Area Junior College	Moberly
	Northeast Missouri State University	Kirksville
	Northwest Missouri State University	Maryville
	Rockhurst College	Kansas City
	Saint Louis College of Pharmacy	St. Louis
	Saint Louis Community College at Forest Park	St. Louis
	Saint Louis University	St. Louis
	Saint Paul's College	Concordia
	School of the Ozarks	Point Lookout
	Southwest Missouri State University	Springfield
	State Fair Community College	Sedalia
	Stephen's College	Columbia
	Tarkio College	Tarkio
	The Principia	St. Louis
	Three Rivers Community College	Poplar Bluff
	University of Missouri-Columbia	Columbia
	University of Missouri-Kansas City	Kansas City
	University of Missouri-Rolla	Rolla
	University of Missouri-St. Louis	St. Louis
	Washington University	St. Louis
	Water and Wastewater Technical School	Neosho
	Webster College	Webster
	Westminster College	Fulton
	William Jewell College	Kansas City
MT	Carroll College	Helena
	College of Great Falls	Great Falls
	Dawson College	Glendive
	Eastern Montana College	Billings
	Flathead Valley Community College	Kalispell
	Miles Community College	Miles City
	Montana College of Mineral Science and Technology	Butte
	Montana State University	Bozeman
	Northern Montana College	Havre
	Rocky Mountain College	Billings
	University of Montana	Missoula
	Western Montana College	Dillon

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
NE	Central Technical Community College	Hastings
	Chadron State College	Chadron
	College of Saint Mary	Omaha
	Concordia College	Seward
	Creighton University	Omaha
	Dana College	Blair
	Doane College	Crete
	Grace College of the Bible	Omaha
	Hastings College	Hastings
	Kearney State College	Kearney
	McCook Community College	McCook
	Midland Lutheran College	Fremont
	Mid-Plains Community College	North Platte
	Northeast Technical Community College	Norfolk
	Platte Technical Community College	Columbus
	Southeast Community College	Lincoln
	Union College	Lincoln
	University of Mid-America	Lincoln
	University of Nebraska	Lincoln
	Wayne State College	Wayne
NV	University of Nevada-Las Vegas	Las Vegas
	University of Nevada-Reno	Reno
	Clark County Community College	Las Vegas
	Northern Nevada Community College	Elko
	Sierra Nevada College	Incline Village
	Western Nevada Community College	Carson City
NH	Colby-Sawyer College	New London
	Dartmouth College	Hanover
	Franklin Pierce College	Rindge
	New England College	Henniker
	NH Technical Institute	Concord
	NH Voc-Tech College of Berlin	Berlin
	NH Voc-Tech College of Claremont	Claremont
	NH Voc-Tech College of Laconia	Laconia
	NH Voc-Tech College of Manchester	Manchester
	NH Voc-Tech College of Nashua	Nashua
	NH Voc-Tech College of Portsmouth	Portsmouth
	Saint Anselm's College	Manchester
	University of New Hampshire	Durham
	White Pines College	Chester
NJ	Atlantic Community College	Mays Landing
	Bergen Community College	Paramus
	Brookdale Community College	Lincroft
	Burlington County College	Penberton
	Camden County College	Caldwell
	Centenary College for Women	Hackettstown
	County College of Morris	Dover
	Cumberland County College	Vineland
	Drew University	Madison
	Fairleigh Dickinson University	Rutherford
	Gloucester County College	Sewell
	Kean College of New Jersey	Union
	Mercer County Community College	Trenton
	Middlesex County College	Edison
	Montclair State College	Upper Montclair
	New Jersey Institute of Technology	Newark
	Ocean County College	Toms River
	Passaic County Community College	Paterson
	Princeton University	Princeton

APPENDIX V
CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Rider College	Trenton
	Rutgers the State University	New Brunswick
	Stevens Institute of Technology	Hoboken
	Trenton State College	Trenton
	Union College	Cranford
	Union County Technical Institute	Scotch Plains
	William Paterson College	Wayne
NM	College of the Southwest	Hobbs
	Eastern New Mexico University-Main Campus	Portales
	Eastern New Mexico University-Roswell	Roswell
	New Mexico Highlands University	Las Vegas
	New Mexico Institute of Mining and Technology	Socorro
	New Mexico Junior College	Hobbs
	New Mexico Military Institute	Roswell
	New Mexico State University-Las Cruces	Las Cruces
	New Mexico State University-San Juan	San Juan
	University of Albuquerque	Albuquerque
	University of New Mexico-Main Campus	Albuquerque
NY	Adelphi University	Garden City
	Albany College Pharmacy	Albany
	Albany Law School	Albany
	Alfred University	Alfred
	Bard College	Annandale-on-Hudson
	Bronx Community College	Bronx
	Brooklyn Law School	Brooklyn
	Canisius	Buffalo
	City University of New York	New York
	Clarkson College of Technology	Potsdam
	Colgate University	Hamilton
	College of Mt. Saint Vincent	Riverdale
	College of Saint Rose	Albany
	Columbia University	New York
	Concordia College	Bronxfille
	Cornell University	Ithaca
	Dowling College	Oakdale Long Island
	D'Youville College	Buffalo
	Erie Community College	Buffalo
	Hamilton College	Clinton
	Hartwick College	Oneonta
	Hilbert College	Hamburg
	Hobart-William Smith Colleges	Geneva
	Hofstra University	Hempstead
	Houghton College	Houghton
	Hudson Valley Community College	Troy
	Hunter College	New York
	Ithaca College	Ithaca
	King's College	Briarcliff Manor
	Long Island University	Greenvale
	Manhattan College	Bronx
	Medaille College	Buffalo
	Mercy College	Dobbs Ferry
	Molloy College	Rockville Centre
	New School for Social Research	New York
	New York Institute of Technology	Old Westbury
	New York Law School	New York
	Niagara University	Niagara University

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Paul Smith's College of Arts & Science	Paul Smiths
	Polytechnic Institute of New York	Brooklyn
	Rensselaer Polytechnic Institute	Troy
	Roberts Wesleyan College	Rochester
	Rochester Institute of Technology	Rochester
	Rockefeller University	New York
	Saint Banaventure University	Saint Bonaventure
	Saint John Fisher College	Rochester
	Saint John's University	Jamaica
	Saint Lawrence University	Canton
	Saint Thomas Aquinas College	Sparkhill
	Skidmore College	Saratoga Springs
	Southampton College	Southampton
	State University of New York at Buffalo	Buffalo
	Syracuse University	Syracuse
	The Cooper Union	New York
	Trocaire College	Buffalo
	Ulster County Community College	Stone Ridge
	University of Rochester	Rochester
	Vassar College	Poughkeepsie
	Wagner College	Staten Island
	Webb Institute of Naval Architecture	Glen Cove
	Westchester Community College	Valhalla
NC	Anson Technical Institute	Ansonville
	Appalachian State University	Boone
	Asheville Buncombe Technical Institute	Asheville
	Atlantic Christian College	Wilson
	Beaufort County Technical Institute	Washington
	Belmont Abbey College	Belmont
	Bennett College	Greensboro
	Bladen Technical Institute	Dublin
	Blue Ridge Technical Institute	Flat Rock
	Brevard College	Brevard
	Campbell College	Buies Creek
	Cape Fear Technical Institute	Wilmington
	Carteret Technical Institute	Morehead City
	Catawba College	Salisbury
	Catawba Valley Technical Institute	Hickory
	Central Carolina Technical Institute	Sanford
	Central Piedmont Community College	Charlotte
	Chowan College	Murfreesboro
	Cleveland County Technical Institute	Shelby
	Coastal Carolina Community College	Jacksonville
	College of the Albemarle	Elizabeth City
	Craven Community College	New Bern
	Davidson College	Davidson
	Davidson County Community College	Lexington
	Duke University	Durham
	Durham College	Durham
	East Carolina University	Greenville
	Elon College	Elon College
	Fayetteville State University	Fayetteville
	Fayetteville Technical Institute	Fayetteville
	Gardner Webb College	Boiling Springs
	Gaston College	Dallas
	Greensboro College	Greensboro
	Guilford College	Greensboro
	Guilford Technical Institute	Jamestown
	Halifax Community College	Weldon
	Haywood Technical Institute	Clyde
	High Point College	High Point
	Isothermal Community College	Spindale
	James Sprunt Institute	Kenansville
	Johnson C. Smith University	Charlotte

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Johnston Technical Institute	Smithfield
	Lees-McCrae College	Banner Elk
	Lenoir Community College	Kinston
	Lenoir-Rhyne College	Hickory
	Livingstone College	Salisbury
	Louisburg College	Louisburg
	Mars Hill College	Mars Hill
	Martin Community College	Williamston
	Mayland Technical Institute	Spruce Pine
	McDowell Technical Institute	Marion
	Meredith College	Raleigh
	Methodist College	Fayetteville
	Montreat-Anderson College	Montreat
	Mount Olive College	Mount Olive
	Nash Technical Institute	Rocky Mount
	North Carolina Agricultural and Technical State University	Greensboro
	North Carolina Central University	Durham
	North Carolina State University	Raleigh
	North Carolina Wesleyan College	Rocky Mount
	Pembroke State University	Pembroke
	Pfeiffer College	Misenheimer
	Piedmont Bible College	Winston-Salem
	Piedmont Technical Institute	Roxboro
	Pitt Technical Institute	Greenville
	Queens College	Charlotte
	Randolph Technical Institute	Asheboro
	Richmond Technical Institute	Hamlet
	Roanoke-Chowan Technical Institute	Ahoskie
	Robeson Technical Institute	Lumberton
	Rockingham Community College	Wentworth
	Rowan Technical Institute	Salisbury
	Saint Andrews Presbyterian College	Laurinburg
	Saint Augustine's College	Raleigh
	Saint Mary's College	Raleigh
	Salem College	Winston-Salem
	Sampson Technical Institute	Clinton
	Sandhills Community College	Carthage
	Shaw University	Raleigh
	Stanly Technical Institute	Albermarle
	Surry Community College	Dobson
	Technical Institute of Alamance	Burlington
	Tri-County Technical Institute	Murphy
	University of North Carolina at Chapel Hill	Chapel Hill
	University of North Carolina at Charlotte	Charlotte
	University of North Carolina at Greensboro	Greensboro
	University of North Carolina at Wilmington	Wilmington
	Wake Forest University	Winston-Salem
	Wake Technical Institute	Raleigh
	Warren Wilson College	Swannanoa
	Wayne Community College	Goldsboro
	Western Carolina University	Cullowhee
	Western Piedmont Community College	Morganton
	Wilkes Community College	Wilkesboro
	Wilson County Technical Institute	Wilson
	Wingate College	Wingate
	Winston-Salem State University	Winston-Salem

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
ND	Bismarck Junior College	Bismarck
	Dickinson State College	Dickinson
	Jamestown College	Jamestown
	Lake Region Junior College	Devils Lake
	Mary College	Bismarck
	Mayville State College	Mayville
	Minot State College	Minot
	North Dakota State School of Science	Wahpeton
	North Dakota State University-Main Campus	Fargo
	North Dakota State University-Bottineau	Bottineau
	Trinity Bible Institute	Ellendale
	University of North Dakota-Main Campus	Grand Forks
	University of North Dakota-Williston	Williston
OH	Antioch College	Yellow Springs
	Art Academy of Cincinnati	Cincinnati
	Bluffton College	Bluffton
	Capital University	Columbus
	Case Western Reserve University	Cleveland
	Central Ohio Technical College	Newark
	Central State University	Wilberforce
	Cincinnati Bible College	Cincinnati
	Cincinnati Technical College	Cincinnati
	Clark Technical College	Springfield
	Cleveland Institute of Art	Cleveland
	Cleveland Institute of Music	Cleveland
	Cleveland State University	Cleveland
	College of Mount St. Joseph on the Ohio	Cincinnati
	College of Steubenville	Steubenville
	College of Wooster	Wooster
	Columbus College of Art and Design	Columbus
	Columbus Technical Institute	Columbus
	Cuyahoga Community College	Cleveland
	Davis Junior College	Toledo
	Defiance College	Defiance
	Denison University	Granville
	Franklin University	Columbus
	Hebrew Union College	Cincinnati
	Heidelberg College	Tiffin
	Hiram College	Hiram
	Hocking Technical College	Nelsonville
	Jefferson County Technical Institute	Steubenville
	John Carroll University	Cleveland
	Josephinum College of Liberal Arts	Worthington
	Kent State University	Kent
	Kenyon College	Gambier
	Kettering College of Medical Arts	Kettering
	Lakeland Community College	Mentor
	Lima Technical College	Lima
	Lorain County Community College	Elyria
	Lutheran Theological Seminary	Columbus
	Malone College	Canton
	Marietta College	Marietta
	Marion Technical College	Marion
	Medical College of Ohio	Toledo
	Miami-Jacobs Junior College	Dayton
	Miami University	Oxford
	Mount Union College	Alliance
	Mount Vernon Nazarene College	Mount Vernon
	Muskingum Area Technical College	Zanesville
	Muskingum College	New Concord
	National Training and Operational Technology Center (EPA)	Cincinnati
	North Central Technical College	Mansfield

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Northwest Technical College	Archbold
	Notre Dame College	Cleveland
	Oberlin College	Oberlin
	Ohio Board of Regents-Technical Education Offerings	Columbus
	Ohio Dominican College	Columbus
	Ohio Northern University	Ada
	Ohio State University	Columbus
	Ohio University	Athens
	Ohio Wesleyan University	Delaware
	Owens Technical College	Perrysburg
	Saint John College of Cleveland	Cleveland
	Sinclair Community College	Dayton
	Stark Technical College	Canton
	Tiffin University	Tiffin
	United Theological Seminary	Dayton
	University of Cincinnati	Cincinnati
	University of Dayton	Dayton
	University of Toledo	Toledo
	Urbana College	Urbana
	Washington Technical College	Marietta
	Wittenberg University	Springfield
	Wright State University	Dayton
	Xavier University	Cincinnati
	Youngstown State University	Youngstown
OK	Bacone College	Muskogee
	Bartlesville Weslyan College	Bartlesville
	Bethany Nazarene College	Bethany
	Cameron University	Lawton
	Carl Albert Junior College	Poteau
	Central State University	Edmond
	Claremore Junior College	Claremore
	Connors State College	Warner
	East Central Oklahoma State University	Ada
	Eastern Oklahoma State College	Wilburton
	El Reno Junior College	El Reno
	Hillsdale Free Will Baptist College	Moore
	Midwest Christian College	Oklahoma City
	Murray State College	Tishomingo
	Northeastern Oklahoma Agricultural and Mechanical College	Miami
	Northeastern Oklahoma State University	Tahlequah
	Northern Oklahoma College	Tonkawa
	Northwesterm Oklahoma State University	Alva
	Oklahoma Baptist University	Shawnee
	Oklahoma Christian College	Oklahoma City
	Oklahoma City University	Oklahoma City
	Oklahoma Panhandle State University	Goodwell
	Oklahoma School of Business, Accountancy, Law and Finance	Tulsa
	Oklahoma State University-Main Campus	Stillwater
	Oklahoma State University-Oklahoma City	Oklahoma City
	Oral Roberts University	Tulsa
	Oscar Rose Junior College	Midwest City
	Phillips University	Enid
	Saint Gregory's College	Shawnee
	Sayre Junior College	Sayre
	Seminole Junior College	Seminole
	Southeastern Oklahoma State University	Durant
	South Oklahoma City Junior College	Oklahoma City
	Southwestern College	Oklahoma City
	Tulsa Junior College	Tulsa
	University of Oklahoma-Central Office	Norman

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	University of Oklahoma-Health Science Center	Oklahoma City
	University of Science and Arts of Oklahoma	Chickasha
	University of Tulsa	Tulsa
	Western Oklahoma State College	Altus
OR	Blue Mountain Community College	Pendleton
	Chemeketa Community College	Salem
	Clackamas Community College	Oregon City
	Clatsop Community College	Astoria
	Columbia Christian College	Portland
	Concordia College	Portland
	George Fox College	Newberg
	Judson Baptist College	Portland
	Lane Community College	Eugene
	Lewis and Clark College	Portland
	Linfield College	McMinnville
	Linn-Benton Community College	Albany
	Marylhurst Education Center	Marylhurst
	Mount Hood Community College	Gresham
	Multnomah School of the Bible	Portland
	Museum Art School	Portland
	Oregon State Higher Education District	
	Eastern Oregon State College	La Grande
	Oregon College of Education	Monmouth
	Oregon Institute of Technology	Klamath Falls
	Oregon State University	Corvallis
	Portland State University	Portland
	Southern Oregon State College	Ashland
	University of Oregon-Health Sciences Center	Portland
	Pacific University	Forest Grove
	Reed College	Portland
	Southwestern Oregon Community College	Coos Bay
	Treasure Valley Community College	Ontario
	Umpqua Community College	Rosenburg
	University of Portland	Portland
	Warner Pacific College	Portland
	Western Baptist Bible College	Salem
	Western Conservative Baptist Seminary	Portland
	Western Evangelical Seminary	Portland
	Williamette University	Salem
PA	Allegheny College	Meadville
	Allentown College of St. Francis De Sales	Center Valley
	Alliance College	Cambridge Springs
	Beaver College	Glenside
	Bloomsburg State College	Bloomsburg
	Bucks County Community College	Newton
	Butler County Community College	Butler
	Cabrini College	Radnor
	California State College	California
	Carlow College	Pittsburgh
	Carnegie-Mellon University	Pittsburgh
	Cedar Crest College	Allentown
	Chestnut Hill College	Philadelphia
	Cheyney State College	Cheyney
	Clarion State College	Clarion
	Community College of Allegheny County	Pittsburgh
	Community College of Beaver County	Monaca
	Community College of Philadelphia	Philadelphia
	Delaware Valley College of Science and Agriculture	Doylestown

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Dickinson College	Carlisle
	Drexel University	Philadelphia
	The Dropsie University	Philadelphia
	Duquesne University	Pittsburgh
	Eastern College	Saint Davids
	East Stroudsburg State College	East Stroudsburg
	Edinboro State College	Edinboro
	Franklin-Marshall College	Lancaster
	Gannon College	Erie
	Geneva College	Beaver Falls
	Gettysburg College	Gettysburg
	Gwynedd-Mercy College	Gwynedd Valley
	Harcum Junior College	Bryn Mawr
	Haverford College	Haverford
	Indiana University of Pennsylvania	Indiana
	Juniata College	Huntingdon
	Keystone Junior College	La Plume
	King's College	Wilkes-Barre
	Lafayette College	Easton
	La Roche College	Allison Park
	La Salle College	Philadelphia
	Lehigh University	Bethlehem
	Lincoln University	Lincoln University
	Lock Haven State College	Lock Haven
	Lycoming College	Williamsport
	Mansfield State College	Mansfield
	Marywood College	Scranton
	Mercyhurst College	Erie
	Millersville State College	Millersville
	Montgomery County Community College	Blue Bell
	Northeastern Christian Junior College	Villanova
	Pennsylvania State University	University Park
	Philadelphia College of Pharmacy and Science	Philadelphia
	Point Park College	Pittsburgh
	Reading Area Community College	Reading
	Saint Fidelis College	Herman
	Saint Francis College	Loretto
	Saint Joseph's College	Philadelphia
	Saint Vincent College	Latrobe
	Seton Hill College	Greensburg
	Slippery Rock State College	Slippery Rock
	Spring Garden College	Chestnut Hill
	Susquehanna University	Selinsgrove
	Swarthmore College	Swarthmore
	Temple University	Philadelphia
	University of Pennsylvania	Philadelphia
	University of Pittsburg	Pittsburgh
	University of Scranton	Scranton
	Ursinus College	Collegeville
	Villa Maria College	Erie
	Villanova University	Villanova
	Waynesburg College	Waynesburg
	West Chester State College	West Chester
	Westminster College	New Wilmington
	Widener College	Chester
	Wilkes College	Wilkes-Barre
	Williamsport Area Community College	Williamsport
	Wilson College	Chambersburg
PR	Inter American University of Puerto Rico	San German
	The Catholic University of Puerto Rico	Ponce
	University of Puerto Rico	Mayaguez
	University of Puerto Rico	Rio Pedras

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
RI	Brown University	Providence
	Providence College	Providence
	Roger Williams College	Bristol
	University of Rhode Island	Kingston
SC	Aiken Technical Education Center	Aiken
	Baptist College	Charleston
	Bob Jones University	Greenville
	Central Wesleyan College	Central
	Citadel Military College of South Carolina	Charleston
	Claflin College	Orangeburg
	Clemson University	Clemson
	Coastal Carolina College	Conway
	Coker College	Hartsville
	College of Charleston	Charleston
	Columbia College	Columbia
	Columbia Bible College	Columbia
	Converse College	Spartanburg
	Erskine College	Due West
	Florence-Darlington Technical College	Florence
	Francis Marion College	Florence
	Furman University	Greenville
	Greenville Technical College	Greenville
	Lander College	Greenwood
	Limestone College	Gaffney
	Morris College	Sumter
	Newberry College	Newberry
	North Greenville College	Tigerville
	Orangeburg-Calhoun Technical College	Orangeburg
	Piedmont Technical College	Greenwood
	South Carolina State College	Orangeburg
	Sumter Area Technical College	Sumter
	Tri County Technical College	Pendleton
	Trident Technical College	North Charleston
	University of South Carolina	Columbia
	University of South Carolina at Aiken	Aiken
	University of South Carolina at Beaufort	Beaufort
	University of South Carolina at Spartanburg	Spartanburg
	University of South Carolina at Union	Union
	Voorhees College	Denmark
	Winthrop College	Rock Hill
	Wofford College	Spartanburg
SD	Augustana College	Sioux Falls
	Black Hills State College	Spearfish
	Dakota Wesleyan University	Mitchell
	Freeman Junior College	Freeman
	National College of Business	Rapid City
	Northern State College	Aberdeen
	Presentation College	Aberdeen
	Sioux Falls College	Sioux Falls
	South Dakota School of Mines and Technology	Rapid City
	South Dakota State University	Brookings
	University of South Dakota-Springfield	Springfield
TN	Aquinas Junior College	Nashville
	Austin Peay State University	Clarksville
	Belmont College	Nashville
	Carson-Newman College	Jefferson City
	Chattanooga State Technical Community College	Chattanooga

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Christian Brothers College	Memphis
	Cleveland State Community College	Cleveland
	Columbia State Community College	Columbia
	Covenant College	Lookout Mountain
	Cumberland College	Lebanon
	David Lipscomb College	Nashville
	Dyersburg State Community College	Dyersburg
	East Tennessee State University	Johnson City
	Fisk University	Nashville
	Freed-Hardeman College	Henderson
	Free Will Baptist Bible College	Nashville
	George Peabody College for Teachers	Nashville
	Hiwassee College	Madisonville
	Jackson State Community College	Jackson
	King College	Bristol
	Knoxville College	Knoxville
	Lambuth College	Jackson
	LeMoyne-Owen College	Memphis
	Martin College	Pulaski
	Memphis State University	Memphis
	Middle Tennessee State University	Murfreesboro
	Milligan College	Milligan College
	Nashville State Technical Institute	Nashville
	Roane State Community College	Harriman
	Shelby State Community College	Memphis
	State Technical Institute at Memphis	Memphis
	Steed College	Johnson City
	Tennessee Technological University	Cookeville
	Tennessee Wesleyan College	Athens
	University of the South	Sewanee
	University of Tennessee	Knoxville
	University of Tennessee Center for Health Sciences	Memphis
	University of Tennessee at Martin	Martin
	University of Tennessee at Nashville	Nashville
	Vanderbilt University	Nashville
	Volunteer State Community College	Gallatin
	Walters State Community College	Morristown
TX	Abilene Christian University	Abilene
	Alvin Community College	Alvin
	Amarillo College	Amarillo
	American Technological University	Killeen
	Angelina College	Lufkin
	Angelo State University	San Angelo
	Austin College	Sherman
	Austin Presbyterian Technological Seminary	Austin
	Baylor College of Dentistry	Dallas
	Baylor College of Medicine	Houston
	Baylor University	Waco
	Bee County College	Beeville
	Blinn College	Brenham
	Brazosport College	Lake Jackson
	Cisco Junior College	Cisco
	Clarendon College	Clarendon
	College of the Mainland	Texas City
	Concordia Lutheran College	Austin
	Cooke County College	Gainesville
	Dallas Bible College	Dallas
	Dallas Christian College	Dallas
	Dallas County Community College District	
	Eastfield College	Mesquite
	El Centro College	Dallas
	Mountain View College	Dallas
	Richland College	Dallas

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Dallas Theological Seminary	Dallas
	Del Mar College	Corpus Christi
	DeVry Institute of Technology	Dallas
	East Texas Baptist College	Marshall
	East Texas State University	Commerce
	El Paso Community College	El Paso
	Frank Phillips College	Borger
	Galveston College	Galveston
	Grayson College	Denison
	Gulf Coast Bible College	Houston
	Hardin-Simmons University	Abilene
	Henderson County Junior College	Athens
	Houston Baptist University	Houston
	Houston Community College	Houston
	Howard College at Big Spring	Big Spring
	Howard Payne University	Brownwood
	Huston-Tillotson College	Austin
	Incarnate Word College	San Antonio
	Jacksonville College	Jacksonville
	Jarvis Christian College	Hawkins
	Kilgore College	Kilgore
	Lamar University	Beaumont
	Laredo Junior College	Laredo
	Lee College	Baytown
	Le Tourneau College	Longview
	Lon Morris College	Jacksonville
	Lubbock Christian College	Lubbock
	McLennan Community College	Waco
	McMurry College	Abilene
	Midland College	Midland
	Midwestern State University	Wichita Falls
	Navarro College	Corsicana
	North Harris County College	Houston
	North Texas State University	Denton
	Odessa College	Odessa
	Our Lady of the Lake University of San Antonio	San Antonio
	Pan American University	Edinburg
	Panola Junior College	Carthage
	Ranger Junior College	Ranger
	Rice University	Houston
	Saint Edward's University	Austin
	Sam Houston State University	Huntsville
	San Antonio College	San Antonio
	San Jacinto College	Pasadena
	Schreiner College	Kerrville
	Southern Bible College	Houston
	Southern Methodist University	Dallas
	South Plains College	Lovelland
	South Texas College of Law	Houston
	Southwestern Assemblies of God College	Waxahachie
	Southwestern Baptist Theological Seminary	Fort Worth
	Southwestern Christian College	Terrell
	Southwestern Union College	Keene
	Southwestern University	Georgetown
	Southwest Texas State University	San Marcos
	Stephen F. Austin State University	Nacogdoches
	Tarleton State University	Stephenville
	Tarrant County Junior College-Northeast Campus	Hurst
	Tarrant County Junior College-Northwest Campus	Fort Worth
	Tarrant County Junior College-South Campus	Fort Worth
	Texarkana College	Texarkana
	Texas A & I University	Kingsville

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Texas A & I University-Corpus Christi	Corpus Christi
	Texas A & I University-Laredo	Laredo
	Texas A & M University-Main Campus	College Station
	Texas A & M University Moody College of Marine Sciences and Maritime Resources	Galveston
	Texas Christian University	Fort Worth
	Texas College	Tyler
	Texas Lutheran College	Seguin
	Texas Southmost College	Brownsville
	Texas State Technical Institute-James Connally Campus	Waco
	Texas State Technical Institute-Mid-Continent Campus	Amarillo
	Texas State Technical Institute-Rio Grande Campus	Harlingen
	Texas Tech University	Lubbock
	Texas Wesleyan College	Fort Worth
	Texas Woman's University	Denton
	Trinity University	San Antonio
	Tyler Junior College	Tyler
	University of Dallas	Irving
	University of Houston-Main Campus	Houston
	University of Houston-Clear Lake City	Houston
	University of Houston-Victoria Campus	Victoria
	University of Texas-Arlington	Arlington
	University of Texas-Austin	Austin
	University of Texas at Dallas	Richardson
	University of Texas-El Paso	El Paso
	University of Texas Health Science Center at Dallas	Dallas
	University of Texas Health Science Center at Houston	Houston
	University of Texas Medical Branch at Galveston	Galveston
	University of Texas-San Antonio	San Antonio
	Vernon Regional Junior College	Vernon
	Victoria College	Victoria
	Weatherford College	Weatherford
	Western Texas College	Snyder
	West Texas State Universtiy	Canyon
	Wharton County Junior College	Wharton
	Wiley College	Marshall
UT	Brigham Young University	Provo
	Stevens Henager College	Ogden
	University of Utah	Salt Lake City
	Utah Higher Education System Office	
	University of Utah	Salt Lake City
	Utah State University	Logan
	Southern Utah State College	Cedar City
	Weber State College	Ogden
	College of Eastern Utah	Price
	Dixie College	Saint George
	Snow College	Ephraim
	Utah Technical College at Salt Lake City	Salt Lake City
	Westminster College	Salt Lake City

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
VT	Champlain College	Burlington
	Johnson State College	Johnson
	Lyndon State College	Lyndonville
	Marlboro College	Marlboro
	Middlebury College	Middlebury
	Norwich University	Northfield
	Saint Michael's College	Winooski
	School for International Training	Brattleboro
	Southern Vermont College	Bennington
	Trinity College	Burlington
	University of Vermont and State Agriculture College	Burlington
	Vermont Institute of Community Involvement	South Burlington
	Vermont Technical College	Randolph Center
	Windham College	Putney
VA	Averett College	Danville
	Bridgewater College	Bridgewater
	College of William and Mary	Williamsburg
	Eastern Mennonite College	Harrisonburg
	Eastern Virginia Medical School	Norfolk
	Emory and Henry College	Emory
	Ferrum College	Ferrum
	Hampton Institute	Hampton
	Institute of Textile Technology	Charlottesville
	J. Sargeant Reynolds Community College	Richmond
	Madison University	Harrisonburg
	Old Dominion University	Norfolk
	Radford College	Radford
	Randolph-Macon College	Ashland
	Randolph-Macon Woman's College	Lynchburg
	Saint Paul's College	Lawrenceville
	University of Virginia	Charlottesville
	Virginia Intermont College	Bristol
	Virginia Military Institute	Lexington
	Virginia Polytechnic Institute and State University	Blacksburg
	Virginia Wesleyan College	Norfolk
	Washington and Lee University	Lexington
	Wytheville Community College	Wytheville
WA	Bellevue Community College	Bellevue
	Big Bend Community College	Moses Lake
	Centralia College	Centralia
	Central Washington State College	Ellensburg
	Clark College	Vancouver
	Columbia Basin Community College	Pasco
	Cornish School of Allied Arts	Seattle
	Eastern Washington State College	Cheney
	Evergreen State College	Olympia
	Fort Steilacoom Community College	Tacoma
	Fort Wright College of the Holy Names	Spokane
	Gonzaga University	Spokane
	Grays Harbor College	Aberdeen
	Green River Community College	Auburn
	Highline Community College	Midway
	Lower Columbia College	Longview
	Lutheran Bible Institute of Seattle	Seattle
	Northwest College of the Assemblies of God	Kirkland
	Olympia Technical Community College	Olympia
	Olympic College	Bremerton
	Pacific Lutheran University	Tacoma
	Peninsula College	Port Angeles

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Seattle Community College District	
	North Seattle Community College	Seattle
	Seattle Community College-Central Campus	Seattle
	Seattle Community College-South Campus	Seattle
	Seattle University	Seattle
	Shoreline Community College	Seattle
	Skagit Valley College	Mount Vernon
	Tacoma Community College	Tacoma
	University of Puget Sound	Tacoma
	Walla Walla College	College Place
	Walla Walla Community College	Walla Walla
	Washington State Community College-District 5	
	Edmonds Community College	Lynnwood
	Everett Community College	Everett
	Washington State Community College-District 17	
	Spokane Falls Community College	Spokane
	Washington State University	Pullman
	Wenatchee Valley College	Wenatchee
	Western Washington State College	Bellingham
	Whatcom Community College	Bellingham
	Whitman College	Walla Walla
	Whitworth College	Spokane
	Yakima Valley College	Yakima
WV	Alderson Broaddus College	Phillippi
	Beckley College	Beckley
	Bethany College	Bethany
	Bluefield State College	Bluefield
	Concord College	Athens
	Davis and Elkins College	Elkins
	Glenville State College	Glenville
	Marshall University	Huntington
	Morris Harvey College	Charleston
	Parkersburg Community College	Parkersburg
	Potomac State College	Keyser
	Salem College	Salem
	West Liberty State College	West Liberty
	West Virginia Institute of Technology	Montgomery
	West Virginia University	Morgantown
	Wheeling College	Wheeling
WI	Alverno College	Milwaukee
	Beloit College	Beloit
	Blackhawk Technical Institute	Janesville
	Cardinal Stritch College	Milwaukee
	Carroll College	Waukesha
	Carthage College	Kenosha
	Concordia College	Milwaukee
	District One Technical Institute	Eau Claire
	Edgewood College	Madison
	Fox Valley Technical Institute	Appleton
	Gateway Technical Institute	Kenosha
	Holy Redeemer College	Waterford
	Institute of Paper Chemistry	Appleton
	Lakeshore Technical Institute	Cleveland
	Lawrence University	Appleton
	Madison Area Technical College	Madison
	Madison Business College	Madison
	Marian College of Fond Du Lac	Fond Du Lac
	Marquette University	Milwaukee
	Mid-State Technical Institute	Wisconsin Rapids
	Milton College	Milton

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Milwaukee Area Technical College	Milwaukee
	Moraine Park Vocational, Technical and Adult Education Institute	Fond Du Lac
	Mount Mary College	Milwaukee
	Mount Senario College	Ladysmith
	Nicolet College and Technical Institute	Rhinelander
	North Central Technical Institute	Wausau
	Northeast Wisconsin Technical Institute	Green Bay
	Northland College	Ashland
	Ripon College	Ripon
	Saint Norbert College	De Pere
	Silver Lake College	Manitowoc
	Southwest Wisconsin Vocational-Technical Institute	Fennimore
	University of Wisconsin-Green Bay	Green Bay
	University of Wisconsin-Madison	Madison
	University of Wisconsin-Milwaukee	Milwaukee
	University of Wisconsin-System Office	Madison
	Viterbo College	La Crosse
	Waukesha County Technical Institute	Pewaukee
	Western Wisconsin Technical Institute	La Crosse
WY	Casper College	Casper
	Eastern Wyoming College	Torrington
	Laramie County Community College	Cheyenne
	Northwest Community College	Powell
	Sheridan College	Sheridan
	University of Wyoming	Laramie
	Western Wyoming Community College	Rock Springs